An Exploratory Study of the Impact of Digital Learning Tools on Student Engagement, Self-Efficacy and Ownership of Learning

by © Dennis James Neufeld

A Thesis submitted to the School of Graduate Studies

in partial fulfillment of the Requirements for the degree of

Master of Education

Faculty of Education

Memorial University of Newfoundland

June 2018

St. John's, Newfoundland and Labrador

Abstract

The modern education landscape is seeing an ever-increasing infusion of technology in schools and classrooms. As teachers and administrators sift through the saturated market of digital learning tools, they might question whether or not these trendy and often flashy tools will have any positive effects on their learners. This exploratory case study seeks to understand the impact that various digital learning tools have had on students who are enrolled in classes whose teachers use various forms of technology. More specifically, through the use of an online survey tool consisting of Likert scale and open-ended questions, this study was designed to better understand the impact of digital learning tools on student engagement, self-efficacy, and ownership of learning at one high school in British Columbia. An analysis of participant responses suggests that learner engagement and self-efficacy are positively impacted by the use of these tools. However, ownership of learning seems not to be directly affected by the use of technology in the classroom. Ultimately, the responses collected and their analysis could help educators at the participating school to make informed decisions when implementing new technology, and it might inspire other schools or districts to look closely at the effect that these tools are having on their specific demographics.

Keywords: digital learning tools, web 2.0, educational technology, engagement, self-efficacy, ownership of learning

Dedication

Without the unending support of my wife Rachael, and the well-placed play breaks provided by my three wonderful children Mayah, Oliver, and Hudson, this process would not yet be finished. I dedicate this paper to my loving and patient family.

Acknowledgements

I would like to acknowledge my two supervisors, Gabrielle Young and Kathy Snow. Thank you for your guidance through what is no longer unfamiliar territory. I would also like to thank the staff and administrative team at Rick Hansen Secondary for your willingness to help and for sharing your time and energy. You made this possible.

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Introduction

This work is based on the assumption that, by introducing a variety of learning tools throughout the semester and by avoiding stagnation, students will be more engaged in class; they will have increased self-efficacy resulting from the familiarity of the online; and that students will possess a greater sense of ownership over their learning.

Being a child of the 80's has provided me with a unique perspective on the development of digital technology and its increasingly tenacious invasion of our modern lives. Digital technology takes many forms and has grasped control of just about every industry, it seems: entertainment, business, home economics, and advertising, to name a few. One San Francisco-based company has even successfully developed a large-scale, portable 3D printer designed to build houses (Moon, 2017). Consequently, statements suggesting that digital technology has become an integral part of our daily lives are not only true, but they are quickly becoming understated. It logically follows then, that education would adopt a digitally infused model as well. My first-hand experience as a student in the 90's allowed me to witness a shift. It started as a classroom novelty, where computers and shiny gadgets were encountered once or twice per week and the event was given a flashy title like *Screen Time*, often taking place in an alternative room or computer laboratory. But this infusion of technology quickly became a regular, if not assumed, part of daily classroom life. By the mid 90's, my classrooms always contained a few computers that provided opportunities to type, rather than write, and to embark on journeys of creative exploration. My high school experience, which turned the millennium, included keyboarding, computer animation, AutoCAD drawing, and information technology courses. This was a gradual but obvious addition to the classroom and, in a modern context, is now

frequently called upon to support learners and, hopefully, not distract them. Therein lies the basis of this study.

In recent years, technology has become an undeniably major part of modern education at secondary and post-secondary levels (Facer & Selwyn, 2013). What used to be a novelty has now become the center of policy design for many districts. It is becoming more common for technology integration to be discussed at international conferences, where institutions and leaders in education share theory and policy:

> Governments of nearly every country in the world now have well-established policy drives and programs seeking to encourage and support the use of digital technologies in schools, colleges, and universities. Digital technology is a topic that is of significance to a global educational audience (Facer & Selwyn, 2013, p.1).

Digital learning tools are having such an impact, and they are becoming so commonplace, that the buzz-phrase *technology in education* could soon lose its impact since it might simply be assumed that education institutions are infusing their instructional design and delivery with technology. The issue is that, while the industries of education and technology are moving ahead quickly, schools are slow to catch up. As such, any inquiry that we make about technology adoption is important. Schools and districts want to make informed decisions around technology integration and learners must, of course, be at the center of that decision.

The Educator's Role

If technology has become such an integral part of our modern world that citizenship is no longer a geographical-political identity, but also a digital identity, then our learners have changed and the role of educator has also evolved. Technology provides levels of learning,

communicating and reflecting that simply aren't seen in traditional face-to-face environments. Even tools such as email which provide group communication may now be viewed by some as being traditional by modern standards, so the importance of current, relevant learning tools that foster these elements is undeniable. As our learners evolve as digital citizens, so must educators. The modern educator is responsible for teaching young people how to effectively, respectfully and safely navigate the digital world (Rovai & Jordan, 2004).

Educators must begin to view learners, especially those at elementary and secondary levels, as digital natives whose level of literacy meets the minimum requirements for simple navigation online. The modern learner is digitally literate but not digitally fluent. The difference is that one who is digitally literate understands and can execute basic functions, while one who is digitally fluent grasps the complexity and interconnectedness of the digital realm, including software, hardware, files, tools and also their own actions (MacKenzie, 2016). Rovai (2004) would agree with McKenzie (2016) in saying that the educator's role is no longer to deliver content, but to ensure that our learners become digitally fluent contributors in a world constructed with zero's and one's, so to speak.

With the information gathered during this study, it is intended that the focus school, and perhaps others, would be able to make informed, student-centered decisions around technology integration.

Rationale and Significance

Current literature suggests that modern learners, who have grown up in a digital context, benefit academically as well as socially from these digital formats (Jain & Getis, 2003; Nam & Smith-Jackson, 2007; Neo, 2003; Wallace, 2004). There is immense value in using social media and other web 2.0 tools as a means of active content creation rather than just as a means of

passive content consumption. Content creation itself is too often neglected in media literacy conceptualizations and certainly so in the context of pedagogy (Vanwynsberghe & Verdegem, 2013). Vanwynsberghe and Verdegem refer to Sonia Livingstone in their paper *Integrating Social Media in Education*, proposing that "excluding creation from a media literacy definition would be a gross underutilization of the internet's potential, especially in the era of social media when people have the opportunity to be both consumers and producers of media content" (2013, p.5). Four arguments are distinguished for the context of education:

1. The pedagogic argument, namely that youth learn best through making it by their own,
2. The employment argument that people who are able to create media messages themselves become more valuable in the labor market,
3. The cultural argument that citizens have the right to self-expression and cultural participation, and
4. The political argument that the creation of media messages stimulates democracy and active citizenship (Vanwynsberghe & Verdegem, 2013, p.5).

The paper suggests that, although academic success has been made apparent as a result of digital learning tools, the utilization of the internet's potential to develop citizenship and social growth is becoming increasingly necessary.

Henry Jenkins, program director of comparative media studies at the Massachusetts Institute of Technology, observes an online culture that has emerged and has identified these qualities there within:

> low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices. A participatory culture is also one in which members believe their contributions matter (2009, p.3)

Jenkins termed this observation "participatory culture" which implies that digital citizens must engage as consumers and contributors simultaneously and ubiquitously (2009, p.3). One cannot be a digital citizen by using only one of these. Hence, both are desired and must be present to establish self-efficacy.

Adults may assume that all young people are adept users of social media and other web 2.0 tools and, therefore, teachers may overlook these topics when designing their classrooms or curriculum delivery. It is not yet commonplace for schools to adapt to this environment and "while compulsory education obliges all children to read and write, learning how to deal with social media is not a component of current educational curricula" (Vanwynsberghe & Verdegem, 2013, p.7). So, it becomes necessary, now, for teachers, administrators and districts to consider not only the academic implications of education's digital infusion, but also the effects that this movement is having and will continue to have on our learners as digital citizens. If it can be established that, by using these tools, learners will engage with curriculum, that they will believe they can be successful, and that they will desire to learn for the sake of learning, then this research poses great value to all stakeholders.

The adoption of technology in classrooms is an exciting frontier. As stated, it is crucial that educators make informed and student-centered decisions regarding the infusion of technology. This thesis has been organized into 4 chapters. In chapter 1 you will find a review

of current and relevant literature around the topic of technology in education. The chapter provides a context for this study. Chapter 2 describes the methodology and research methods that were utilized to conduct the study. Among other things, it describes the research design and execution, as well as ethical concerns. Chapter 3 presents the study's results and underscores interesting observations made. The fourth and final chapter discusses the results; it analyzes participant responses and synthesizes the qualitative open-ended responses with those generated by the Liker-scale questions.

Literature Review

The objective of this study is to explore the impact that digital learning tools have had on learners' engagement, self-efficacy, and ownership of learning. The literature review section will unpack these terms to provide a more comprehensive definition, since the term *motivation* is commonly used synecdochally, encompassing many smaller and more specific qualities, which results in a vague and ambiguous understanding of learners' experiences with technology. The creation of new means for collaboration through the introduction of technology in education will be addressed and will lead into a discussion of school culture. This is followed by an exploration of research that has already been conducted which relates to the use of digital learning tools in education. In doing so, a context of existing knowledge will be established from which to examine and to synthesize participant responses in the following chapters.

Defining Motivation

What exactly is the role of digital technology in education and what effect does it have on students' motivation to learn? Andrew Martin (2014) describes motivation as representing "the inner drive and activity that provides the impetus, energy and direction required to develop and sustain one's knowledge and competence." Martin explains that a learner's will to succeed and the skills that are required to do so are directly related, and that this relationship is cyclical in nature. A learner's will to succeed motivates him to develop skills, which then further motivate him to build on those skills (see figure 1 - Cycle of academic will and skill).

In the context of this study then, the term *motivation* has been unpacked to include engagement, self-efficacy, and ownership of learning, which must also be defined.

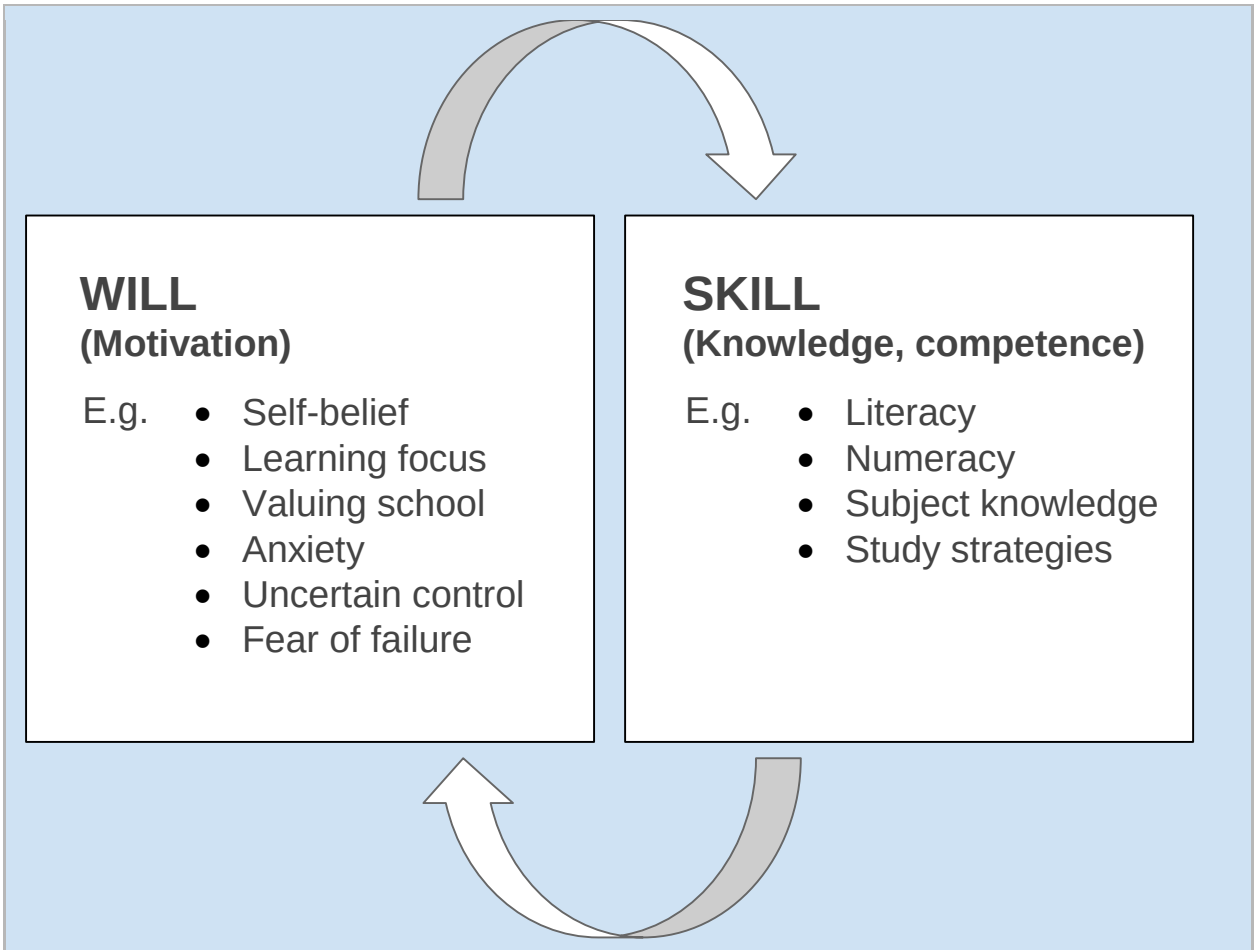

Figure 1 - Cycle of academic will and skill (Martin, 2014, retrieved from https://www.psychology.org.au/inpsych/2013/december/martin/)

In their book, *A Reconstructed Conception of Learner Engagement in Technology Rich Online Learning Environments*, Gillow-Wiles and Niess (2018) say that educators' views of learner *engagement*, prior to the infusion of modern technology in classrooms, are insufficient. These views may have described engagement as a general enthusiasm and willingness to partake in learning events. It is further explained that this view, however, lacks granularity and should be broken down into four, more comprehensive, elements: "engagement with the learning

community; engagement with the technology; engagement with the content of the learning event; and engagement within the intersection of all three" (Gillow-Wiles & Niess, 2018, p.20). Engagement, in the modern education context, can therefore be defined as an earnest and enthusiastic exploration of content, taking into account the relationship between curriculum, technology and relevant communities.

For this reason, *self-efficacy* works in tandem with engagement, contributing to learners' motivational constructs. The term's original definition, coined by Albert Bandura, describes self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p.3). Cognitive theorists have redefined learner self-efficacy as a "metacognitive capability" which influences choices around approach, investment of effort, longevity of perseverance, and whether to approach a task "anxiously or with assurance" (Vakani, Sheerani, Afzal, & Amim, 2012, p.109). Efficacious learners "tend to persist, cope, and adapt well, even when they have no prior experience. Learners who have low confidence in their ability to study can become frustrated, overwhelmed, and demotivated—they are more likely to achieve low grade point averages and, in some cases, drop out" (Taipjutorus, Hansen, & Brown, 2012, p.56).

The third ingredient in this granular description of learner motivation is *ownership of learning*. This can be defined as a state of mind in which it is recognized that meaningful learning and, consequently, academic success stem from a personal pursuit of understanding and a personal pursuit to "achieve worthy goals." Ownership of learning is easily achieved in a learner-centered community, referring to schools and classrooms, where curiosity and inquiry are the driving factors that pull students through curriculum (O'Connell & Vandas, 2015).

The term *motivation* has been unpacked to reveal its granular construct in the context of this study: engagement, self-efficacy, and ownership of learning. But the question of the effect that digital learning tools have on these qualities remains.

Digital Learning Tools Impact Engagement

Self-efficacy around these digital learning tools appears to be linked to their frequency of use. This was observed in teachers who used educational technology for the first time. The more fluent they became, the more interested they were in using that technology in their practice. Yasar Akkan, Ünal Cakirglu, and Bülent Güven (2012) propose that perhaps, like the aforementioned teachers, if students were effectively trained in using educational technology, rather than assuming their fluency, they might be more inclined to use it extensively. But this observation begs the question, does fluency with a piece of technology or set of technologies increase interest or is it the reciprocal scenario: does an interest in technology increase fluency?

Akkan et al. (2012) conducted a case study using qualitative and quantitative methods involving 31 teacher participants in a high school, seeking to analyze the effect of web-based instruction applications on school culture. Through surveys, interviews and classroom observations, they noticed that, as teachers used the technology more, their interest appeared to increase as well.

> As the weeks passed by, the teachers loaded more and more materials to the system and with the increase of new student and teacher members in the system, the interest and usage of web-based materials increased as well. They noted that, as teachers became more engaged, so did their students. (Akkan, et al., 2012, p.1045).

The simple act of teachers using educational technology in their classrooms has a big impact on school culture and engagement. It is postulated that the change of ideas and beliefs of

teachers in the school may play a role in forming a new culture (Wu, Hsu, & Hwang, 2008). Sahin (2011) would agree and suggests that there is direct correlation between digital learning tools and the level of learner engagement since this is part of the reason technology is in use in education today. While Sahin's (2011) study focused on the development of school culture, the findings begin to support the driving question of this research.

Digital Learning Tools Impact Self-efficacy

While digital technology has been in development for decades, its implementation in education is relatively modern, at least at its current level of infusion. The primary focus of research around technology's impact on learners has, understandably, been focused on academic success. Unfortunately, there is comparatively little research exploring the link between digitally infused classrooms and their impact on learner self-efficacy, motivation, and ownership of learning.

Rovai and Jordan (2004) point out that distance education, a sect of modern education that is foundationally designed using digital technology, including robust learning management systems (LMS's), and smaller digital learning tools that might include social media and other applications, requires that learners be self-motivated. If a learner possesses a fear of technology, common among adult learners or even younger learners whose lives are less impacted by digital technology, then they simply will not work toward conquering their digital shortcomings (Rovai & Jordan, 2004). Students and teachers display varied emotions when reacting to new educational technologies. These emotions include enthusiasm, paralyzing fear, and a whole host of emotions in between (Collins, 1999). This is troubling because Abrahamson (1998) reported that distance education required students who were self-regulated and independent. Learners

who fear technology or those who fear change will likely struggle because they might not be motivated to overcome their fears and discomforts.

Digital Learning Tools' Impact on Ownership of Learning

Similarly, motivation in learners is associated with attitude, which stems from classroom culture. Many definitions of culture exist, as it is a vague title. If it can be assumed that culture includes engagement and self-efficacy and that these lead to ownership of learning, then Vanwynsberghe (2013) suggests social media literacy greatly impacts these factors.

While investigating the qualities of school culture in urban elementary schools, Sahin (2011) postulated that systems in education (be it assessment, school culture, policies, etc.) that become stagnant are problematic. Educators' duties ought not be to create new instructional methods and techniques. Instead our duties are to question the status quo and to foster new ideas as they arise naturally (Johnson & Johnson, 1989).

In addition to breaking down figurative classroom walls and inviting students to demonstrate their learning to a global audience, researchers have observed academic benefits to using digital learning tools (Jain & Getis, 2003; Nam & Smith-Jackson, 2007). Specifically, Jain and Getis's (2003) experiment in which half of the participating students experienced online instruction, while the rest encountered the same material using traditional classroom methods revealed that internet-based instruction methods were viable and even more academically beneficial. The integration of digital learning tools enhances learning on many levels, including academic results, and could soon become a recognizable and key component of student success (Neo, 2003; Wallace, 2004).

Motivation for academic success, however, is not a component of ownership of learning. As defined previously, ownership of learning is a sincere desire to explore for the sake of

satisfying one's curiosity. The term *inquiry* is often used synonymously. In their study of school culture, Akkan, Guven, and Cakiroglu (2012) suggest that technology may be a key factor in developing a culture that fosters ownership of learning. Using digital learning tools in classrooms may make it easier for students to value curricular content and might motivate them alongside their academic goals.

Flipped or blended classrooms that primarily use a variety tech tools to deliver and explore content, tools such as video, PowerPoint, and online discussion forums, may help to spark learners' interests. These alternative approaches to the traditional stand-and-deliver model which often lacks technology, give students a sense of freedom that boosts the desire to learn (Goodwin & Miller, 2013). "A review of literature has shown that flipping learning can improve student's academic achievement, promote self-paced learning, and increase student–teacher interaction" (Chen, 2016, p.412). Existing research on this topic may be limited, but it does suggest that digital learning tools may impact ownership of learning.

Technology Simplifies the Logistics of Learning

Dr. Judith R. Merz (2010) notes in her interview with Dr. Nancy Sulla, president of Innovative Designs for Education (IDE Corp.) and transformative technology specialist, that education has a rich history that is based on isolation. Both teachers and students functioned as islands, visible to each other but rarely engaging in a collaborative sense. School was competition. She elaborates, saying, "students were commanded to 'do [their] own work' and compete (never collaborate) with others for the best grades and test results. Subject areas were regarded as discrete entities, taught in separate time slots or departments" (Merz, 2010, p.49).

Certainly, some of these qualities still exist in modern education, but their focus has undoubtedly shifted. Merz's (2010) interview suggests that technology is a key factor in breaking the barrier of isolation and that collaborative processes are simplified as a result.

The introduction of web tools that foster user generated content (UGC) and seamless collaboration has given the evolution of education a significant and undeniable boost. Web 2.0 tools, a term coined to describe this next level of online interactivity, have led to "increased multiculturalism and globalization" in education (Merz, 2010). These tools and their use in education align with a social constructivist approach to learning. Ehrhardt (2010) adjusts the traditional definition of the theory, coined by "Soviet psychologist and father of social constructivist learning theory" Lev Vygotsky, to fit a modern context. "In online practice, social constructivism involves students learning from and with each other in computer-mediated collaborative learning communities" (Ehrhardt, 2010, p.67), once again suggesting that traditional processes are simplified by integrating technology.

It can be assumed that most educators desire for their pupils to make connections between curriculum, themselves, and the world around them. But, even the global aspect of this perspective has been a competitive, isolated, and inward one. Merz (2010) explains that with web 2.0 tools, educators shift their,

> efforts to build connections rather than competition between and among students and subject areas … Clearly the Internet and the Worldwide Web have contributed significantly to the changes noted above, allowing teachers and students to move beyond schoolhouse walls for research and exploration (Merz, 2010, p.50).

Similar to collaboration, the notion of communal learning, where a broad and often public audience brings an element of accountability and standards to the work, is simplified with digital learning tools. In education, the notion appears to be part of a greater effort to establish learning communities amongst students - not just within a school, but globally. "Accordingly, the heart of the instructional leadership is the ability of leaders to change schools from cultures of internal accountability to institutions that can meet the demands of external accountability" (Halverson, Grigg, Prichett, & Thomas, 2007, p.161). Providing this sort of external, communal, and global accountability is a job for which digital learning tools are perfectly suited. Hypothetically, an elementary class of fifth grade students in British Columbia, wanting to connect and communicate with a class of fifth grade students in Ontario to learn about each other's provinces, would find the process more efficient by using technology rather than traditional correspondence. By using these sorts of tools to introduce students to a collaborative and communal learning environment, educators may establish a new cultural norm.

This Must Become Our Culture

Akkan, Guven and Cakiroglu (2012) seem to suggest that digital learning tools are certainly integral to fostering engagement, self-efficacy, and ownership of learning, but they must do so to together, affecting each other simultaneously. Akkan et al (2012) suggests that technology is only as effective as the environment in which it is implemented, wherein teacher-confidence and the learner's ability play an integral role. This sort of school culture is a multi-faceted concept and creating it, therefore, requires a complex and nebulous approach.

The modern digital citizen is a product of three major changes in our recent global history: Networked individualism rather than defined social groups; an altered way of organizing professional and leisure activities; and a ubiquitous system of communication

(Vanwynsberghe & Verdegem, 2013). Learners feel more comfortable in this sort of environment. Even, when occupying the same physical space, such as in a traditional bricks-and-mortar classroom, learners may prefer to interact online. This is especially true where Web2.0 tools are in use and learners play a role in shaping the online environment. User Generated Content (UGC), such as Wiki's or discussion forums, have become commonplace on most social media and social learning platforms, including learning management systems. Pierre Bourdieu (1986) defines *cultural capital* as the "subtle modalities in the relationship [between] culture and language." From his work, it can be gleaned that social platforms such as these are part of our new cultural capital. Digital social interaction is our communication platform, our new language, and is therefore synonymous with our culture. The essentiality of technology is an ingredient in our culture but we ought to note that face-to-face interaction is an equal part of that culture and, therefore, of learning (Merz, 2010). We ought to embrace the advancement of educational practice while honoring the facets of traditional approaches that have proven to be valuable.

Summary

At a glance, the modern classroom is a far cry from those a few decades ago. At the extreme ends of the timeline, both students might be seen working, using tablets, but that word's definition has changed significantly. On the early end of timeline, a tablet was a personal learning tool, void of content until the user created it - chalk on slate. Content's existence was limited to the user's immediate need and, at the end of a lesson, it vanished until the user recreated it. Learners were isolated in this experience until they physically shared with each other or the class, leaning over to see their peers' answers. Collaboration and sharing of any kind was limited in the confines of the classroom.

Conversely, on the modern end of the timeline, tablets (used synecdochally here to represent learning technology as a whole, including laptops, desktops, smartphones, etc.) appear to serve the same purpose but provide new elements of collaboration and ubiquity of content. Learning technologies, especially those that might be labelled web 2.0, are inherently collaborative learning tools. Learners may appear isolated when they are seen sitting in solitude, staring at a screen. But the interactivity and social-collaborative nature of this action is hidden; the digital realm is active, albeit often unseen. Content exists before the user even accesses the technology and it is entirely ubiquitous. When using web 2.0 tools, collaboration and sharing is assumed and extends infinitely beyond classroom walls.

This study explored the impact that digital learning tools, in their many forms, have had on learner engagement, self-efficacy, and ownership of learning. These concepts, especially the last, are complex and can be difficult to define. Much research exists, proving the correlation between digital learning tools and academic success of the modern learner. In their study of seventh grade learners, Kadikoy, Istanbul, Akgündüz, and Akinoglu (2017), observed a significant increase in academic success, directly resulting from the implementation of blended learning models and from the inclusion of social media applications in education. Similarly, Ceylan and Kesici (2017) conducted an experimental study of the effects of blended learning theory on middle school students' academic success. They observed an overall increase in student success and their quantitative data supports the notion that digital learning tools have a positive impact on academic success. These scenarios and others like them, if written as an equation, might read like this: Learner + Digital Learning Tools = Academic Success.

But informal observations of my own students have led me to believe that that there is another, perhaps more important, set of learner qualities that results from having used these

tools: engagement, self-efficacy, and ownership of learning, which has led me to my assumptions around this issue. As an equation, my notion might read like this: Unmotivated Learner + Digital Learning Tools = Motivated Learner. These broad-stroke equations serve only to illustrate the motivation behind my study; and they do not acknowledge the many variables that may impact either side of the equations. The point remains: unlike studies with an academic focus, very little research exists on this subject.

Academic success may be one part of the result, but it isn't long-lasting. Success of this nature, in one subject or over the course of one year, doesn't necessarily mean that the same success will continue into the next subject or into the next year. The old proverb springs to mind: Give a man a fish and he eats for a day; teach a man to fish and he eats for a lifetime. This study explores the notion that teaching students to use tools that will engage them in curriculum, that will give them the confidence needed to approach new challenges, and that will foster a love for learning will give them the (life)skills necessary for success in education and in the social-economical world that follows. These are the skills that teachers at the focus school hope to instill in their students by introducing relevant and stimulating technology in their classrooms.

Some of the studies mentioned in this literature review examined educators and professionals who used technology themselves (Akkan, et al., 2012, p.1045) while others examined student use of technology, but only focused on the academic impacts (Jain & Getis, 2003; Nam & Smith-Jackson, 2007). While studies such as Sahin's (2011) did address the notion of healthy school culture which is somewhat connected to my topic, there appears to be very little research directly examining the impact of digital learning tools on student engagement, self-efficacy, and ownership of learning. One such example is a study conducted by Goodwin and

Miller (2013) which suggests that flipped classrooms, which must use some digital learning tools by nature of design, may impact ownership of learning. But there are few modern studies with such a direct connection to my research. As such, this literature review gleans the contents and results of those studies to best support the direction of my research.

The following text describes the selected methodology for conducting this investigation. It rationalizes the research design and methodological choices made. It outlines the role of researcher and data collection methods. The trustworthiness of the findings is also addressed.

Methodology

This study explored the impact that digital learning tools have had on learner engagement, self-efficacy and ownership of learning through an exploratory case study. This chapter describes the research design and context, the participant group, recruitment process, the researcher's role, as well as the methods used for data collection and analysis.

Research Design

The qualitative nature of this research design seeks to gain insightful and detailed reflections on learner experiences using digital learning tools in the classroom and also those of teachers who designed their courses to include many of these tools. The study explored learner perspectives, reflecting on their personal levels of engagement, self-efficacy, and ownership of learning. Learners were asked to reflect on these qualities at three stages in their development: prior to the current semester, midway through the semester, and at a point that is approximately three weeks from the semester's end.

This exploratory study's purpose is to open a discussion by asking the question, 'What is technology's role in creating engagement, a belief in one's self as a learner, and an ownership of one's learning?' rather than to identify universal laws or hard facts around the use of technology in the classroom. If the goal is to gain insight and to provoke further inquiry on the subject, then "this type of question is a justifiable rationale for conducting an exploratory case study, the goal being to develop pertinent hypotheses and propositions for further inquiry" (Yin, 1994, p.5). According to Yin (1994), the nature of this sort of question, a 'what' question with an exploratory aim, lends itself to the use of a survey as the primary research tool. The style of research, however, falls under the umbrella of 'case study' when referencing Yin's definition:

A case study is an empirical inquiry that:

- Investigates a contemporary phenomenon within its real-life context, especially when
- The boundaries between phenomenon and context are not clearly evident. (Yin, 1994, p.13)

The phenomenon, in this case, is a perceived increase in learner engagement, self-efficacy, and ownership of learning. The context, in this case, is the recent surge of digital learning tools being used in classrooms at this school.

One might challenge the validity of the collected responses and their analysis when the source is a single case, unique in many ways. This is a justified concern. The resulting responses will likely be anomalous because the participants are enrolled in a Grade 10, cross-curricular pod; they are part of a one-to-one laptop program; and they are regularly exposed to project-based learning (PBL - an inquiry-based model). Individually, these three qualities do not set this school apart as being entirely unique. Many schools in the Abbotsford district have experimented with cross-curricular projects; there are a few schools whose technology priorities involve providing laptops for their students; and PBL is gaining popularity in the district as well as the province. But to have all three of these factors integrated in one school, functioning simultaneously to deliver an education experience that is reflective of 21st century life, *that* is unique, and it is precisely why *this* school was selected for study. When students first enroll at the focus school in the 9th grade, they learn that the school's initiative includes a one-to-one laptop program where each student uses a personal laptop as their primary device. At the outset of their high school education, their environment is digital. This simplifies teachers' cross-curricular efforts, it opens the figurative classroom doors which invites students to engage as digital citizens, thus creating a unique learning experience.

It is entirely understandable that one might be concerned over the validity of the information when it has been sourced from such a unique case. However, Yin (1994) addresses these concerns, comparing case studies to "scientific facts [which] are rarely based on single experiments; they are usually based on a multiple set of experiments which have replicated the same phenomenon under different conditions" (p.10). The resulting information from this exploratory case study, using a survey, will shed light on the subject, something that is beneficial for stakeholders. And hopefully, the study will inspire further research in other cases or perhaps in a general scope and on a larger scale.

Research Context

This study examined tenth grade students at a high school in Abbotsford, British Columbia (BC), Canada. In 2017, while this study was conducted, the rural city is BC's eighth largest school district, boasting 46 schools which are "attended by almost 19,200 full and part-time students at 30 elementary schools, 8 middle schools, 1 combined middle-secondary school, and 7 secondary schools. In addition, the District has a virtual school, an Aboriginal education centre, an International student program, and offers continuing education courses and an annual summer school" (Abbotsford School District 34, 2017).

The focus school, built in 1993, has seen an unfortunate and significant decline in enrollment over the last decade. While the reasons for this decline are largely speculative, its impact is not. Since schools in BC receive per-student funding, a decrease in enrollment manifests itself as a decrease in elective courses and extracurricular activities. At its peak, the school was attended by 1,300 students, well over its capacity, while at its lowest, the school was home to 597 learners.

The school's recent history, however, is driven by a set of new initiatives, introduced in 2015, which hope to reverse the negative impacts of the enrollment crises. These initiatives include project-based learning (PBL), standards-based assessment practices, cross-curricular pods of students, schools of science and business (specialty streams that operate as programs within the high school), one-to-one laptops, intense focus on creating technology-infused classrooms, and a primary focus on using Google Apps for Education (GAFE) for blended and flipped learning.

Teacher adoption of these initiatives are mandated. Meaning, teachers are expected to work toward adopting each initiative, but that they may do so at a reasonable pace. It is worth mentioning that, without having conducted a formal study, the general attitude amongst staff toward these changes has been positive. Teachers at this school have enthusiastically adopted the initiatives and there are a number of noticeable changes as a result (common assessment language across departments and grade levels is one such example), but most notable and applicable to this study is that student fluency with digital technology appears to have changed. In the classroom, learners spend more time using digital learning tools and they explore a greater variety of tools than in years past. All, of course, due to the mandated change. It is also worth noting that, since the initiation of these changes, enrollment at the school has begun to turn around and, at the time of writing, the school is attended by 630 learners.

Justifiably so, staff, administrators and the district are delighted to see that in 2017, enrollment is on the rise for the first time in over a decade. Personally, as a staff member of nine years at this school, I can say that the positive shift in school culture over the past two years is palpable.

The school's demographics reflect the community in which it lies. Being less than one kilometer down the road from the city's newest and largest Sikh Temple, the surrounding population is primarily Indo-Canadian. The population is certainly still a diverse one, represented microcosmically in the school's hallways which include students from Japanese, Korean, African-American, Vietnamese, and German descent. Many Indo-Canadian students at this school live in multi-family houses, where relatives and extended family members also reside. Annual household incomes range from $30,000 to over $100,000, with the median household income being $62,350. The neighborhood is difficult to label as either upper, middle or lower class, but instead, it includes elements of all three; with statistics indicating that 10.7% of this neighborhood's population is designated "low income" (City of Abbotsford, 2014). This information simply highlights the diversity within what may be perceived as a uniform demographic.

Participants

It has been stated that the focus school was selected based on its unique approach to classroom instruction. The specific participant group was selected due to ease of accessibility – they are my students, which has awarded me the opportunity to observe them informally as they experience the school's changes. With this study, I have been able to collect information that will not only aid teachers and administrators at this school in selecting appropriate learning tools as the initiative progresses, but it will help me design my teaching to suit the needs of my learners.

Participants of this study are divided into two groups: teachers and students. Teacher participants come from a group made up of three categories, broadly speaking: teachers of current grade 10 pod courses, teachers of grade 9 pod courses in which current grade 10 students

were previously enrolled, and teachers who may not be a part of the pod system but who use digital learning tools extensively in their classroom. All teacher participants are employed at the focus school at the time of this study.

Student participants in this study are tenth grade learners and are part of the school's cross-curricular pod initiative. This program groups learners into pods of 25-30 students. Each pod travels together between their English, Social Studies, and Science classes. The pod teaching team consists of three teachers, one for each curricular subject. While the courses are scheduled the same as any other high school in BC, operating with a semester timetable, the lines between these three subjects are slightly blurred as the teaching team designs cross-curricular projects that help learners identify and appreciate the connections between those subjects. I teach the English component of the pod and so all student participants are my students.

In the focus school, every student in grades nine through eleven has a laptop computer available to them. The one-to-one laptop initiative, first introduced three years ago to the grade nine class only, requires families to provide a laptop or Chromebook for their enrolled child. Any circumstances where families may not be able to afford this expense are handled on a case-by-case basis, but it is always assured that each learner will have this technology available to them for the duration of the school year. Since this initiative is in its third year, at the time of writing, the only students who are not part of the one-to-one program, are those in the twelfth grade. This will of course not be the case in the year that follows, where every student enrolled at this school will be included.

Teachers of the Grade 9 class, which is also grouped into cross-curricular pods, work diligently to make use of the ubiquitous technology available to students. The tenth-grade students who participated in this study are, therefore, quite familiar with digital learning tools,

both individualistic and collaborative, by the time they enter my classroom. While there are always cases where some students are less familiar (perhaps they are new to the school or district, or perhaps they have a fear of technology), it is understood that student participants will have already attained basic media literacy skills and that these skills will hopefully develop further over the course of the semester. For this study, I have adopted an understanding of media literacy as defined by Sonia Livingstone, professor of Media and Communications at the London School of Economics: "Media literacy is the ability to access, analyze, evaluate and create messages across a variety of contexts" (Livingstone, 2004).

It is very likely that students will have varied degrees of fluency with media, but the majority of participants were enrolled at this school for the 9th grade and will, therefore, have taken a Digital Literacy course. Those students who are from other schools or districts may not have had this or any other training.

Recruiting

The recruiting processes for teacher and student participants differed slightly because students are under the legal age for consent and therefore require parental consent before participating in this sort of research. Teachers were emailed an information letter and a link to the survey which, on its first screen, also linked to the information letter. Teachers were able to access the survey at any time for the duration of the study so that it would not interfere with their busy schedules (see Appendix A to view the information letter for teachers).

Student recruiting took place during the school day while they attended one of their three pod classes (English, Science, or Social Studies). I prepared a slideshow presentation which was delivered by a third-party non-teacher using a script which I also prepared (see Appendix B to view each slide and its corresponding script). I was not present while recruiting was conducted.

These actions were taken so as not to have my position of authority (actual or perceived) influence the students' decision to participate. During the presentation, students were given an informed consent letter and instructed to take it home and, if they wished to participate, to discuss the opportunity with their parents or guardians. If students wished not to participate, then they were asked to recycle the letter or simply leave it behind after the presentation (see Appendix C to view the informed consent letter).

Informed consent letters were collected by our administrative assistant in the school office and placed in an opaque envelope. This envelope was stored and locked in the school office at the end of each day until the date of the survey arrived.

Role of the Researcher

Since the study was conducted entirely using a survey tool, and since no observations of students were made during the delivery of the survey, my role as the researcher had little to no impact on the results of the survey. As the primary researcher, however, I was cognizant of the possibility that participants might feel uncomfortable being entirely honest or detailed in their responses to survey questions because they may feel that their responses could have a negative impact on our teacher-student or collegial relationship. To address this possibility, multiple reminders were formally and informally made during the recruiting process, as well as the outset of the survey, to ensure participants that the survey was entirely anonymous and that no negative impact could be had.

Since the student participants are all learners in my classroom, they were, at the point of survey delivery, familiar with informal reflection on the use of digital learning tools. Informally, learners are often asked if the tools were helpful or if they were enjoyable to use. For this reason, I believe that there is little possibility that student participants would have been

uncomfortable reflecting on their semester in this way. It is recognized, however, that this experience was more formal than that with which learners were familiar. So, this new formality may have broken the familiarity of the reflective process for participants.

Staff members at this school are provided bi-weekly collaboration periods. These "collab days," as they are colloquially referred to, are periods during which colleagues reflect on the use of digital learning tools, assessment practices and project design. Thus, teacher participants in this study were also familiar with the process of reflecting on their experiences and it was not expected that any discomfort would be experienced.

Data Collection Methods

A survey consisting of Likert-scale questions and open-ended questions was presented to participants. A separate version was designed for each participant group: students and teachers. See Appendices D and E, respectively, for a comprehensive list of survey questions. The Likert-scale questions produced quantitative information in terms of how many students may have felt comfortable with digital learning tools prior to this semester, for example. Although the Likert-scale questions in the survey produced numeric data, this was not a mix-method study. The quantitative nature of these questions served to support the qualitative, open-ended responses, which provided a narrative reflection from the learner's perspective. The numbers clarified response statements that might have been vague or underdeveloped.

Once parental consent was granted via an informed consent form that was sent home to parents as part of the recruiting process, student participants met in an available classroom, outside of regular instructional time, under the supervision of a third party non-teacher. Participants therefore were not made to feel uncomfortable by my presence during the survey session, a factor that might have otherwise influenced their responses. A link to the online

survey was provided to students at this time and they were asked to complete the survey in one sitting, which took between 20 and 30 minutes. Students were given more than enough time to complete the survey so that they did not feel pressured to rush or to submit incomplete answers. Teacher participants received a link to the survey via email as part of the recruiting process, which included an information letter prior to accessing survey questions.

The survey was accessible to teacher participants until the end of the research timeline. During recruitment and at the outset of the survey, it was recommended that participants finish the survey in one sitting.

Analysis

Once responses were collected, the analysis process began with coding. Before beginning, it was necessary to make "the decision to analyze the data by hand or by computer" (Creswell, 2012, p.26). I chose to use a hybrid of the two approaches because my process would essentially be a manual one, where each response would be examined by hand and keywords would be manually recorded, but this would all be done using digital tools: multiple instances of a Microsoft Excel document. These instances were later combined to amalgamate the findings and to ensure that all anonymous responses were kept safe within a single encrypted file. I preferred a manual approach but desired the convenience and efficiency of computer software.

Creswell highlights the importance of reliability when analyzing qualitative results. In this case, while the Likert scale questions in both surveys produced numeric data, alongside the open-ended questions, both sets of responses produced results that required interpretation. The qualities of this study, according to Creswell (2012), best fit the interrater reliability style, having used only one version of the research instrument for each group, and having been administered only once. "Because this method obtains observational scores from two or more individuals," in

this case a third-party coder, “it has the advantage of negating any bias that any one individual might bring to scoring” (Creswell, 2012, p.161).

An anonymous critical friend, a fellow teacher who is employed in the Abbotsford School district but not at the focus school, served as third-party coder, working in tandem with the primary researcher to identify patterns and themes. A preliminary exploratory analysis was conducted. This was a first pass to “obtain a general sense of the data, memoing ideas, thinking about the organization of the data and considering whether [more information was needed].” (Creswell, 2012, p.243). We followed Creswell’s model of the coding process for qualitative research, which can be seen in figure 2.

Once an initial read-through had been conducted, the remainder of the coding process was approached question-by-question so that we were able to focus on patterns that emerged from sets of responses to single questions. Coders identified broad patterns or themes and assigned colour codes for ease of grouping thereafter. These colour codes were broad strokes because, keeping Creswell’s design in mind, we anticipated that many themes would emerge from within each of these preliminary groupings. Responses with negative tones or those that responded negatively to survey questions were given the red colour code. Three shades of red were assigned based on whether the response referred to the beginning, middle or end of the semester. Similarly, three shades of green were assigned to positively toned responses. Responses with a neutral tone or with a general, non-superlative, and non-hyperbolized feeling of satisfaction were assigned the colour beige. Regardless of which question participants were responding to, a bright blue colour was assigned to responses that mentioned or demonstrated ownership of learning, directly or indirectly. A light shade of blue was assigned to responses that reflected a loss of ownership or disinterest in learning. Bright pink and dark pink colours

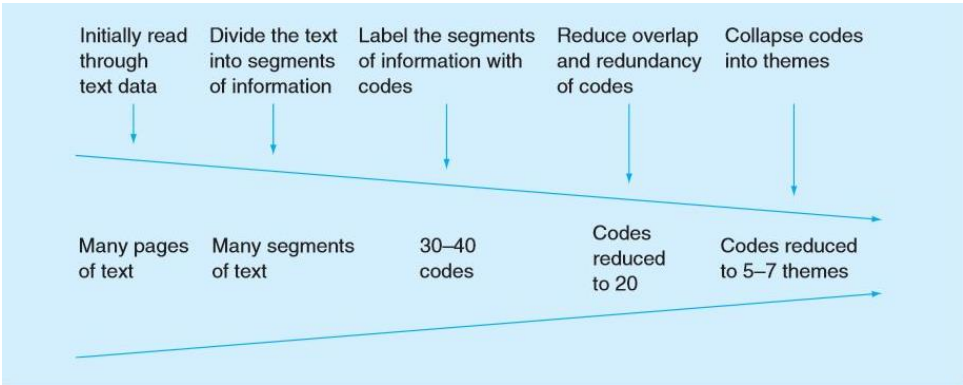

Figure 2. A Visual Model of the Coding Process in Qualitative Research (Creswell, 2012, p.244)

were assigned to responses discussing the helpfulness or unhelpfulness of digital learning tools, respectively. These colour codes were created after the first read through and were applied during the second read through, after which the principle researcher and critical friend shared their code assignments. At this stage, no striking differences were found, and coders generated a list of keywords that would granulate the results and provide a deeper base from which to analyze.

Since all recorded responses exist in an encrypted Microsoft Excel document, coders would be able to use the conditional search function to isolate participants' responses that contained any of these keywords. However, a response that expressed, for example, an element of distraction that digital learning tools create, may not actually have used the word "distraction." The participant may have described a scenario, from which the researcher gleaned that the student became distracted. Likewise, some responses may have used the word "distracted" without meaning to discuss distractions at all. So, simply searching for the keyword "distracted" would not suffice. To solve this issue, coders created hashtag keywords that would be tagged directly into each response on the response sheet. These hashtags mimic the appearance and

function of those commonly found in social media applications and seemed an appropriate and entirely functional means of sorting the information, considering the subject of this study. Any response that discussed the issue of distraction, whether in a positive or negative light, was tagged with #distract. The hashtag #techdistract was applied to any response that discussed the issue of distraction as it directly related to the use of technology. It should be noted that these hashtags were added to the *end* of each response so as not to interfere with or impact its meaning.

During this read through, as coders were tagging responses, a list of additional keywords was being generated. Coders compared lists, identified and combined redundant keywords and generated new hashtags to be assigned during the next read. Ultimately, 27 keywords and colour codes were created and assigned across the responses. This fell just short of Creswell's recommended 30-40 range (see figure 1) but seemed to suffice for the scope of this study.

After examining the newly assigned codes, any redundancies were eliminated and overlapping codes (those similar enough to be considered identical) were combined. Once multiple read-through's and code reductions had been done, the remaining codes and any new ones that emerged were grouped thematically. Using Microsoft Excel's conditional search feature, coders isolated responses that contained various keyword combinations. Themes began to emerge and an effort was made on the parts of both coders to conclude this process with a final theme count that fell within Creswell's recommended amount: 5-7 themes (2012). Refer to Appendix F for a list of major themes.

Trustworthiness

Bias is inevitable in qualitative research analysis because the position of the researcher, in this case myself, cannot be entirely removed from the analysis perspective. All interpretations of

participant responses are potentially affected by the researcher's own perspective. Personally, I bring excitement and enthusiasm to the study. It is the sense of newness, provided by the ever-evolving nature of technology in education, that sparks and maintains my interest in blended learning environments. My hope that technology will continue to find a relevant and important place in education risked creating a biased perspective from which to analyze participant responses. However, the motivation to conduct this study stemmed from a desire to discover whether or not learners' *digital* interests play a role in developing their own *educational* interests. As stated, the purpose of the study was to describe the relationship between digital learning tools and learner engagement, self-efficacy and ownership of learning. To ensure that any potential bias was not present, a critical friend was used during the coding process and frequent check-in's with both the critical friend and the project supervisors helped to ensure that research and analysis moved forward without bias.

The study sought to describe levels of engagement, self-efficacy and ownership of learning at varying points during the semester; qualities that may not be measurable outside of participant reflection. Therefore, survey questions were designed to collect insightful responses from participants, describing their perceived levels of engagement, self-efficacy, and ownership of learning. According to Yin (1994), this satisfied a crucial element of research trustworthiness, its construct validity. Additionally, since the survey's questions did not deal with issues specific to the focus school, and since they could be asked of students at any school that has decided to introduce this level of technology in its classrooms, the element of external validity was also satisfied (Yin, 1994).

Furthermore, to establish that every response was thoroughly analyzed, without focusing on just those that were well-written or those that supported my initial expectations, an

identification system was used, but did not compromise the anonymity of the study. An alpha system was used in place of pseudonyms, to extend this sense of anonymity so that readers would feel the information source was a group of unnamed participants. Responses were sorted by timestamp, which was automatically assigned by the survey tool, and were then assigned an alpha code, beginning with an uppercase *A*. Since the number of participants (32) exceeded the number of alpha characters, the code would reset when it reached its end, while adding a second, lowercase character: *Aa*. On its first pass, the code ranged from *A* to *Z*, followed by a second pass, ranging from *Aa* to *Zz*.

Once the survey was delivered and results satisfied the query or reached the point of saturation, where major themes have been identified and "no new information can add to [the] list of themes or to the detail for existing themes" (Creswell, 2012, p.251), then the unbiased and anonymous third-party coder was once again consulted. Once both parties completed the coding process, as previously described and adhering to the methods Creswell highlights, it was considered whether or not member checking was necessary. For the purposes of this exploratory case study, the collected responses appeared complete but, had they not, then it would have been necessary to conduct member checking. No responses or themes required further unpacking or clarification to answer the driving question. Prior to recruiting, however, the process of member checking was reviewed with my research supervisor, should the necessity have arisen. If member checking was deemed necessary, then the primary researcher was prepared to approach the necessary participants to seek clarification or elaboration. Since the survey was conducted anonymously, a small group of participants would have, in that case, been contacted to curate this group so that a broad and unbiased set of explanations and elaborations would be collected. This, however, was not deemed necessary once coding was complete.

Ethical Approval

The Interdisciplinary Committee on Ethics in Human Research (ICEHR) assistive technology Memorial University granted ethical approval for this project, and formal consent was obtained from the Abbotsford School District (SD34) prior to conducting this study (See Appendix G - ICEHR Ethics Approval and Appendix H - SD34 Ethics Approval). Once ethical approval and permission from the SD34 was obtained, administrators at the focus school were informed of the study's intentions, the potential benefits of the research, and the process by which it would be conducted. Verbal approval was granted and assistance was offered.

Potential non-teacher recruiter proxies were approached both in person and via email. During this correspondence, the project's intentions, benefits, and processes were outlined. The recruitment script was also shared at this point so that proxies could review it and feel comfortable delivering the information to participant groups. Teacher information letters were sent via email and included a link to the online survey.

Student participants' parental consent forms were collected in our school office by an administrative assistant. Forms were stored in an opaque envelope and locked safely at the end of each day. Once the day on which the survey was to be conducted arrived, the envelope containing these consent forms was collected (but not opened) by the principal investigator and delivered to the survey supervisor, a third-party non-teacher. These forms remain in the envelope and are locked securely, where they will remain for 7 years after the survey, at which time they will be shredded.

For the duration of the study, collected responses were stored in an encrypted file which was housed on Google servers. As the principal investigator, I had sole access to this password-protected file. Once data collection was complete, that file was downloaded and removed from Google servers. It was then stored on an external hard drive, which was and remains disconnected from any computer when not in use. As the principal investigator, I have sole access to this password-protected file. It will remain in my possession for a 7-year period, after which, it will be deleted.

Summary

This research project was carefully designed in hopes that its results would answer my driving question: what impact do digital learning tools have on student engagement, self-efficacy, and ownership of learning? A question of this nature calls for exploratory study and a case study methodology to better understand this unique school and participant group. Likert-scale and open-ended questions were delivered via online survey and attention was paid to ensure that the research was conducted ethically and efficiently. The following section outlines the findings of this study.

Results

Participant Profile

Two groups were targeted for recruitment: students who were enrolled in the Grade 10 pod (or those who were enrolled in single classes that were linked to the pod) and teachers at the focus school who used digital learning tools beyond just the school-mandated Google applications. During the recruiting process, 86 students viewed a brief presentation that outlined any required details in order to make an informed decision about whether or not to participate in this study. Each student was handed an informed consent document, to be taken home, reviewed and signed by parents if participation was desired. From that group, 20 females, 11 males, and 1 unidentified gender chose to participate, totaling 32 participants.

The student recruitment group consisted of 3 types of students, when considering their relationship to the Grade 10 pod: students who were enrolled in last year's Grade 9 pod and are now enrolled in the Grade 10 pod; students who were *not* enrolled in last year's Grade 9 pod but are now enrolled in the Grade 10 pod; and students who are enrolled in one of the three Grade 10 pod classes but are not enrolled in the others and are thus not part of the pod itself. While the recruitment group consisted of these three types of students, the resulting participant group did not.

The students who chose to participate were all enrolled in the Grade 10 pod. This is worth noting because we do have a small number of students who were enrolled in one of the three pod courses (English, Science or Social Studies), but not in the others. As a hypothetical example, a 12th grade Korean international student may be enrolled in Physics 12, Biology 12, Carpentry 12, and because of his language level, English 10. This student would share his English class with the pod, but would not be enrolled in the pod itself. Students with these sorts

of scenarios were invited to participate during the recruiting process, but ultimately, only pod students chose to participate. Personally, I had hoped that some of these students would choose to participate because their perspective, attending courses inside and outside the pod, would provide a valuable perspective, being able to immediately compare their experience to other academic courses that were not designed to include a host of technology. These wishes were, of course, not expressed during the recruiting process since that would have created pressure to participate and may have devalued the other participants' responses.

The targeted teacher group can also be divided into three sub groups: those who were teaching the English 10 pod, those who taught the same group previously as part of the English 9 pod, and those who had no affiliation with the pod group but who identified themselves as avid classroom technology users. While the student survey asked participants to identify these qualities, the teacher survey did not, in the interest of anonymity. With such a small recruitment group and small eventual participant group, it is likely that knowing these qualities would remove the sense of anonymity. Consider this hypothetical example: if it were known that a teacher participant identified herself as being female and a grade 9 pod teacher, then it would not have been difficult to deduce the participant's identity. Therefore, any questions that would reveal these sorts of identifying qualities were omitted from the teacher survey.

A group of 10 teachers met the requirements for participating in this study and were invited to take the survey. From that group, 4 chose to participate.

Both the student and teacher surveys were comprised of a mix of Likert scale questions and open-ended questions. The student survey questions (see Appendix D) were designed to have participants reflect on their semester in three stages: beginning, middle, and end. The goal being to measure, in a sense, the development, deterioration or stagnation of their engagement,

self-efficacy, and ownership of learning as they relate to the use of digital learning tools. The open-ended questions provided insightful reflection while the Likert scale questions quantified those reflections.

Description of Intervention

At the outset of this study, I postulated that a semester of learning in a digital environment, using digital learning tools which included an LMS, processing applications such as Google's docs, sheets, sites, and slides, and online learning apps such as Kahoot, Socrates, and Quizler, would be beneficial to learners. Specifically, I suggested that students would be more engaged in class; they would have increased self-efficacy resulting from the familiarity of the online environment and from working with digital tools alongside their peers; and that students would possess a greater sense of ownership over their learning, meaning that they would find value in the work they are doing and even seek to further their understanding outside of class time.

The classroom was converted to a blended one, where a mix of instruction in face-to-face and digital environments took place. Google Classroom was used as the primary means of assignment delivery and collection, as well as the hub for feedback and class discussion. The Google Apps for Education (GAFE) suite was used primarily for word processing and other collaborative efforts. Additional third-party applications that served as quizzing games, digital flashcards, essay organizers, vocabulary generators, research tools, artistic design tools, and a host of other tools were used alongside the GAFE suite. Students used their laptops and encountered digital learning tools on a daily basis. To illustrate the extent to which these tools were used, it was not uncommon for students to find themselves charging and draining their laptop batteries repeatedly in a single day.

Analysis of Participant Responses

Responses were collected anonymously, using an online survey which consisted of Likert-scale and open-ended questions. During the analysis process, outlined in the methodology section, six major themes emerged: digital learning tools appear to increase perceived engagement, but can become a distraction; the logistics of a digital environment provide operative ease and a sense of self-efficacy; feelings of control and comfort help learners proceed efficaciously; ownership of learning appears not to be directly affected by the use of digital learning tools; ownership of learning is not linked to study habits; and teachers expect too much from students and may be overworking them.

As explained in the methods section of this paper, to differentiate between participants and to maintain trustworthiness of analysis, an alpha system was used as an identifying tool. After responses were collected, each anonymous participant was assigned an alpha code, ranging from *A* to *Z*, and then again from *Aa* to *Zz* once all characters had been exhausted. The number of participants exceeded the number of available characters, which necessitated a second pass.

Participants were asked to reflect on their level of engagement (motivation and interest, as they were phrased in the survey questions) in the subject material, as they were at the beginning of the semester. Results were typical for this demographic and met my start-of-semester expectations. There was a mix of positive, negative and neutral responses. An emergent theme was that motivation is linked to interest. Those with low levels of interest, weren't very motivated. Student G shared, "I was not that motivated. That's because what we learned was not that interesting to me." To contrast, those with even mild interest levels seemed quite motivated and eager to start. Student D explained, "I was pretty motivated. I love learning about new things and the idea of projects lets me explore my own interests." Another participant

responded, “I was excited for new projects because I wanted to improve and do better than I did last year” (Student Bb). There were also a number of fairly neutral responses which supported my interpretation, that motivation and interest are linked. “My level of excitement for the project depended on what it was about. If the project was about something that interested me then I found that I got more excited…” (Student Cc).

Examining the responses to questions that asked learners to reflect on their mid-to-end-of-semester engagement revealed that only 10 participants reported low levels of engagement and, of those 10, only 7 reported that they felt higher engagement at the outset of the semester. Furthermore, of those 7 participants, only 2 suggested that their loss of engagement came as a result of technology-use in the classroom. One of these participants attributed this loss specifically to the absence of physicality in modern education - there were no physical papers to touch and hold. Once the laptop was shut, the assignments weren’t visible and there were no physical reminders to do any work (the entire response can be found in Appendix I).

On the other hand, 15 participants reported high levels of engagement and 7 reported that their engagement was directly related the use of technology in the classroom. Student C mentioned two projects that were done in his English class. “In English we had a lot of creative projects like the emoji story and the pop character poster. I kind of get excited.” These two projects, the Emoji Story and the Pop Character Poster were infused with a heavy dose of digital tools. In short, the Emoji Story is a short inquiry project that asked learners to explore the elements of storytelling that help writers communicate powerful themes. The final piece of the project challenged learners to write a powerful short story using *only* Emoji’s (sometimes called emoticons), after which they submitted a reflection that discussed the success or failure of their story and the qualities that led to its success or failure. In this project, learners explored writing

within a modern context, using relevant digital tools. Similarly, the Pop Character Poster, which was part of a novel study, used an online character builder app to help students design a version of themselves, if they were a character in our given novel. Rather than spending time stressing over artistic insecurities, often brought on by the requirement to draw and colour, students used the app to do the drawing *for* them, allowing them to focus on the reflective, symbolic, and narrative pieces of the project. Student S stated, "The presentation of projects, being more technology based, removed the stress of colouring and spending hours on one drawing."

Having participants reflect on their early self-efficacy levels revealed that 81.3% believed they could be successful this semester and perhaps even outperform themselves when compared to years past. More specifically, 56.3% of the participant group believed they could be successful, while 25% believed *very strongly* that they would be successful. During the semester, once assignments and projects were underway, the number of students who believed they could be successful decreased to just 64.6%. While this apparent dip was disappointing, it was affirming to find that 32.3% of the participant group believed very strongly that they would be successful. Many student responses in the open-ended question sections suggested that, in digital environments such as this case, a link exists between self-efficacy and logistic ease. One participant explained that a particular digital learning tool, among others, smoothed out what could have been a bumpy road. Some tasks such as creating a bibliography, for example, could have been daunting or cumbersome for young writers. Using web applications such as Easybib and BibMe, required students to be cognizant of the role that citations play in ethical research, but removed the awkwardness of stumbling around a web article, trying to find publication details. "As class goes on and having to complete many projects, it is definitely much easier to

just put in the link and have a citation instead of going on the hunt for all the needed information" (Student Dd).

Those that reported having ownership of their learning at the beginning of the semester, extending their learning beyond the classroom on their own time, occupied 40.7% of the participant group, and 53.2% reported a genuine interest in the subject material, saying that they were looking forward to learning. By the end of the semester, however, those numbers shifted. Only 32.3% of the participants reported plans to extend their learning beyond the courses, and 50% claimed to have a genuine interest in the subject material. While this result was slightly disappointing from a personal perspective, having hoped to witness the development of these qualities, not an apparent deterioration, these numbers highlighted two factors that should be noted.

The phrasing of one Likert scale question may have negatively impacted its interpretation, thus affecting the reporting of ownership at the semester's end. The statement to which participants would agree or disagree read, "Now, at the end of the semester, I plan to extend my learning beyond the semester, seeking more on my own time" (see figure 3, Problematic phrasing of a question). Students may have interpreted this question as meaning, "Now that this semester is complete, will you continue to study *this* material and further your understanding of *these* subjects on your own time?" If that were the case, then low numbers, similar to those reported, would be expected in response to the question. Logically, students would not continue to pursue a previous semester course load when they face a new semester with four new courses. However, what was meant to be communicated is, "Now that this semester is complete, as you move forward in your education, will you continue as someone who values learning and does so on your own time?"

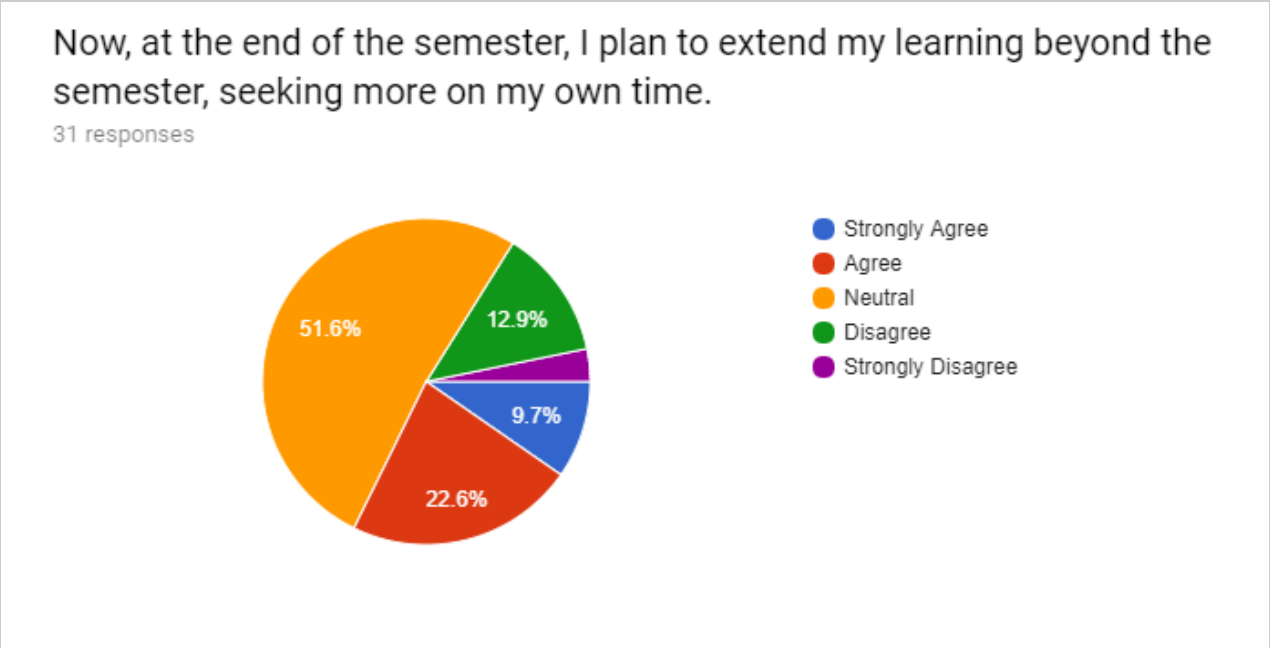

Figure 3. Problematic phrasing of a question.

Responses to a question formed in this manner may have produced more accurate and reliable results. That does not guarantee that the results would be different, but they would be more reliable. A design flaw.

Emergent Themes

As outlined in the methodology section of this paper, the coding process resulted in the identification of six major themes, each one describing commonalities across participant responses and taking triangulation into account by considering teacher participant responses. These six themes are unpacked here.

Digital learning tools appear to increase perceived engagement, but can become a distraction. Based on the responses provided by student and teacher participants, it appeared there may be a connection between digital learning tools and increased study habits. When the

semester began, 46.9% of the participants reported that they felt they possessed very good study habits (18.8% agreed and 28.1% strongly agreed). During the semester, the number of participants who felt their habits were very good was 53.1% (40.6% agreed and 12.5% strongly agreed). To contrast this, 100% of teacher participants strongly agreed; they felt students had very poor study habits at the beginning of the semester. By the end of the semester it seemed as though both student and teacher perceptions were maintained, the only apparent difference being that, this time, teachers felt less strongly about the matter.

It is important to remember, though, that these are perceptions. Students *feel* that they had good study habits. This may include class time, homework, or even simply time spent thinking about subject material. These parameters were not defined in the survey questions. Teachers typically have a very limited view of their students' time. We are often unable to gauge what percentage of a student's time is spent studying. For example, a student-athlete may be involved heavily on multiple teams in a season. His available time is limited and so he may spend 50% of his free time each week studying. In his mind, this is very good. But that may only amount to a few hours each week for all his courses combined. In his teachers' minds, that is *not* enough. For this reason, the perspective from which these responses originate must be held in consideration.

The information that described those who did not report having good study habits is just as interesting as that of those who did. When the semester began, 9.4% of students identified having poor study habits and 43.8% felt neutral on the topic. During the semester, 12.5% of the participants reported having poor study habits and 34.4% felt neutral on the topic. At the end of the semester, not much seemed to have changed, with just 9.4% of the participants reporting poor study habits. The interesting piece of this was that, at the end of the semester, 71.9% of the total

participant group indicated that their study habits were somehow related to the use of digital learning tools in the classroom. Teachers unanimously felt that the digital learning tools in class were helpful in this way. So, although there appeared to be a difference between the participant groups' perceived study habits over the course of a semester, both groups felt that digital learning tools played a role in generating that perceived growth.

To augment that notion, upon investigating, it was discovered that, of all the students who reported having poor study habits, only one felt that digital learning tools were to blame. To contrast, 11 participants (34.4%) claimed to have very good study habits and attributed that quality to the use of digital learning tools. The remaining participants fell into two camps: those who claimed to have very good study habits but did not credit the use of digital learning tools; and those who claimed to have just average (neutral) study habits and *did* attribute that to the use of digital learning tools. While this is hardly conclusive evidence of a link between these tools and the development of outstanding study habits, it warrants further research on the matter. Are there other contributing factors? Future research may wish to include academic results in similar studies. This would reveal and perhaps quantify any discrepancies between learner's perceived study habits and their academic success. For example, one learner may feel that he or she is working hard to learn the content but this may yield little positive outcomes, resulting in decreased efficacy and decreased engagement. This notion is further explored in the future research section.

Additionally, using a variety of digital learning tools appeared to affect engagement, even when the content isn't initially interesting for students. Half of the teacher participants felt that learners found the tools engaging, and the remaining participants felt neutral on the topic - none disagreed. However, according to the participants of this study, for this to occur, the tools need

to be simple to use. "I feel like I'm more engaged with my learning. I found projects like 'the political party project', 'the aquaponics vlog', and 'the emoji story' exiting and fun" (Student O). Each project mentioned in this excerpt from one participant's response were designed to use one simple digital tool: an audio recording app, a video editing app, and an emoji keyboard, respectively. These tools were easy to use and the students reported being engaged as a result.

Furthermore, during the coding process, it was interesting to see just how many students despised a particular web app called Powtoon and the various creative and expressive ways that they communicated that disdain were often vivid. Teacher A explains that the app is "too difficult to get students to work on it. Learning curve was steep and technical requirements although low was a reason to stop trying." This tool is often praised by teachers and it is common for professional development sessions to be offered so as to help train teachers in its use and to inspire projects that might utilize the tool. This not only highlights the point that simplicity is best, but it illustrates that teachers and administrators too often assume that one digital learning tool, based on its popularity among educators and perhaps among some students, will be effective for all. This point will be discussed further in the future research section.

The logistics of a digital environment provide operative ease and a sense of self-efficacy. Student and teacher participants have expressed their appreciation for the day-to-day functionality of the digital environment, specifically the learning management system (LMS) that was used this semester, Google Classroom. Teacher D writes,

> I think Google Classroom was the most helpful. There is no way any student could lose their work or forget a deadline. All resources are held in one place. It also made it easy for students to reach me if they had questions.

When examining responses to questions that asked about individual learning apps that are centered around a single function (or those that are limited in function), perceived engagement is high for some, but that feeling is not unanimous. Some students could not identify a single app that they felt was noteworthy. In other words, students have mixed feelings about which apps were appropriate, helpful or interesting to use. However, the daily functionality of Google Classroom was highly praised almost unanimously. Participants said they enjoyed its ease of use and the ubiquity of materials and resources. LMS's such as Google Classroom and Moodle were always accessible, provided that an internet connection or cellular data signal could be established. Participants also mentioned their appreciation of the reminders that were displayed when opening the app. Things like due dates and teacher announcements were clearly on display and reminder emails were automatically sent when deadlines approached.

Participants explained that collaboration was an important part of their learning process. It appeared that the interconnectedness of social media applications, and the dominant role that it plays in our modern learners' lives established itself as being a part of the way they think. The student participants of this study claimed to want to collaborate and they felt that digital learning tools provided those opportunities. Regarding collaboration, 87.5% felt that the variety of learning tools used in class made collaboration easy, and 62.6% felt that these collaborative opportunities would not have been as easily achieved or as readily received if the same activities had been done using non-digital tools. Across the three subject areas, students frequently made their documents publicly available for review and for collaboration. "Other tools that did small things with big impacts was the cloud that was given to us to share our work with peers. These lead to our worked being reviewed and improved" (Student Ff).

Learners said they preferred to use digital learning tools over traditional learning tools. From this participant group, 75% made this claim. These tools would have included quizzing tools like Kahoot or Quizlet for studying, Google Draw or Paper for collaborative brainstorming, Google docs for group discussion, to name just a few. Traditional tools would have included scantron quizzes and classroom games for studying, doodling on paper or the whiteboard for collaborative brainstorming, or think-pair-share activities for small group discussion. More than half of the participants, 62.6%, attributed this preference to the ease with which they were able to use the tools (while 31.3% felt neutral on the subject and just 6.3% disagreed).

Upon careful consideration of these results, an anomaly was revealed. It appeared that learners were divided in their opinions of communication and feedback. Nearly half of the participants said that they preferred to communicate in a digital setting such as email, document comments, or Google Classroom's built in messaging system. On the other end of the spectrum, slightly more than 40% said they preferred to communicate with their instructor face-to-face. The remaining few were neutral on the topic (see figure 4, Digital communication). The difference between these numbers is negligible and might be described as evenly split. When it came to receiving feedback from their instructor, however, nearly 60% claimed that they preferred to receive it digitally, while less than 30% would have preferred a more traditional format (see figure 5, Digital feedback). These numbers weren't as evenly divided as those around communication, but the amount of students who prefer traditional formats was higher than expected. It seemed strange that nearly 50% of the participant group wished for a more traditional platform in which to ask questions and receive feedback, especially given the number of learners that reported a preference for working in digital environments where they felt familiar, where they felt comfortable, and where they felt they could be more successful.

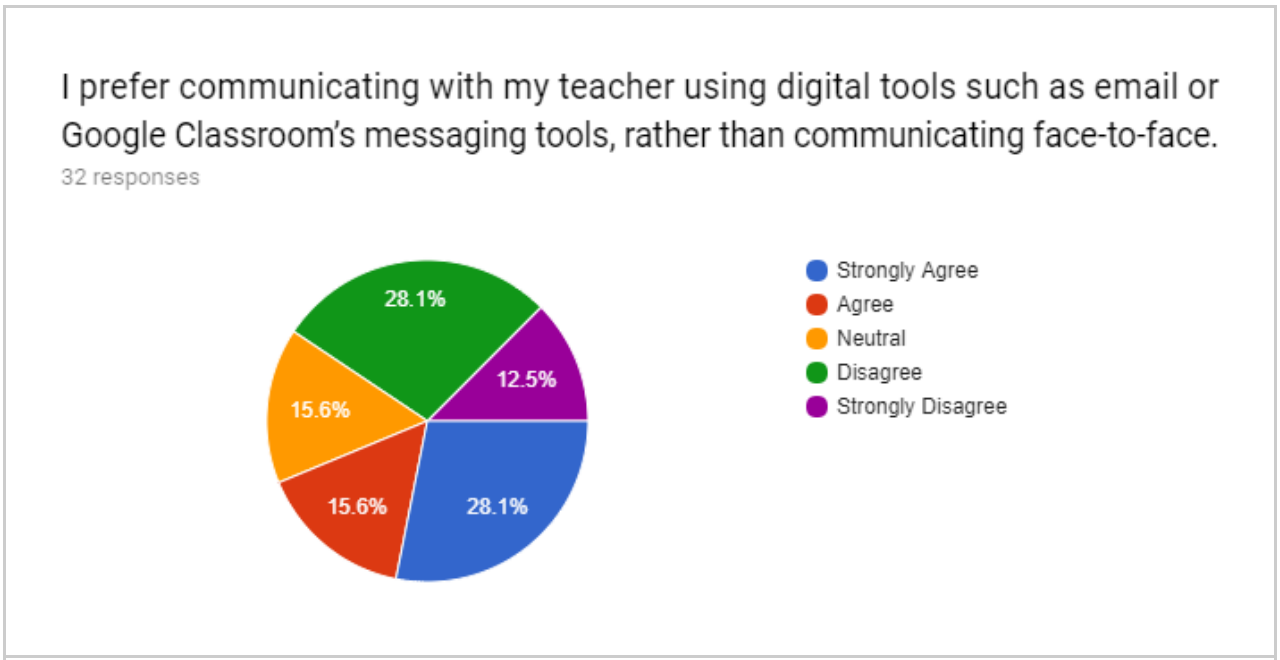

Figure 4. Digital communication

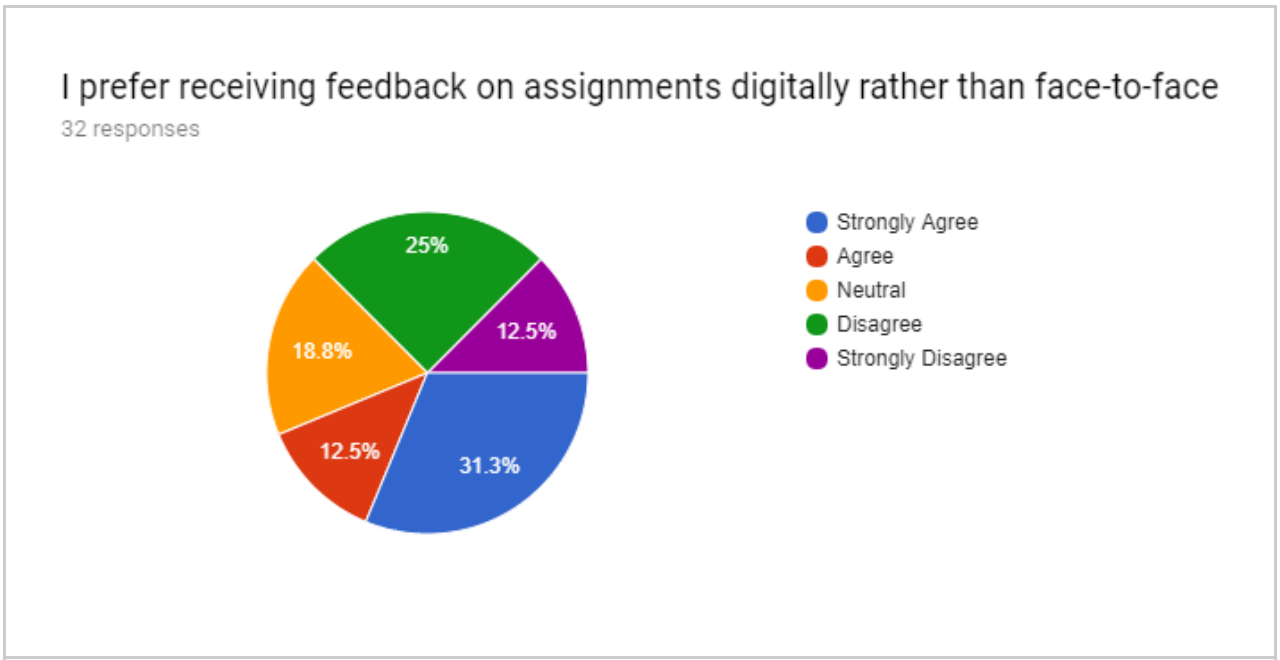

Figure 5. Digital feedback

Despite the apparent craving for traditional communication, it appeared that students were more at ease when assignment and projects were delivered in their preferred environment, a digital one. Students of the Grade 10 pod accessed tasks and content on familiar grounds which, according to participant responses, removed the stress that is often brought on by unfamiliarity. "The presentation of projects, being more technology-based, removed the stress" (Student S). It appeared that, by working in familiar territory and with familiar tools, learners perceived an increase in self-efficacy.

The vast majority of the participants agreed that Google Apps for Education (GAFE) effectively helped them practice skills (learning outcomes related to a demonstrated performance, rather than content knowledge), and more than three fifths of the participants felt that these tools effectively assisted them with comprehending difficult concepts (see figure 6, Practicing skills, and figure 7, Memorizing content, respectively). GAFE seems to have helped learners feel comfortable and confident as they approached the curriculum, thus playing key a role in the development of feelings of self-efficacy.

Feelings of control and comfort help learners proceed efficaciously. Students were often given the freedom to choose how they would approach a project. The perspective from which to approach, and the tools that learners would use were left up to them. Student H praised this freedom, saying, "It allows me to work at my own pace and get things done the way I wanted them to be done." Teacher C explained that LMS's like "Classroom and, or Moodle [are] an effective delivery system, but in terms of content/assignment delivery probably no different to the student than pre-digital delivery." This may explain why, although a number of students identified themselves as not being entirely tech-savvy, none expressed any discomfort around the use of these LMS's. Survey results suggested that, if learners felt comfortable

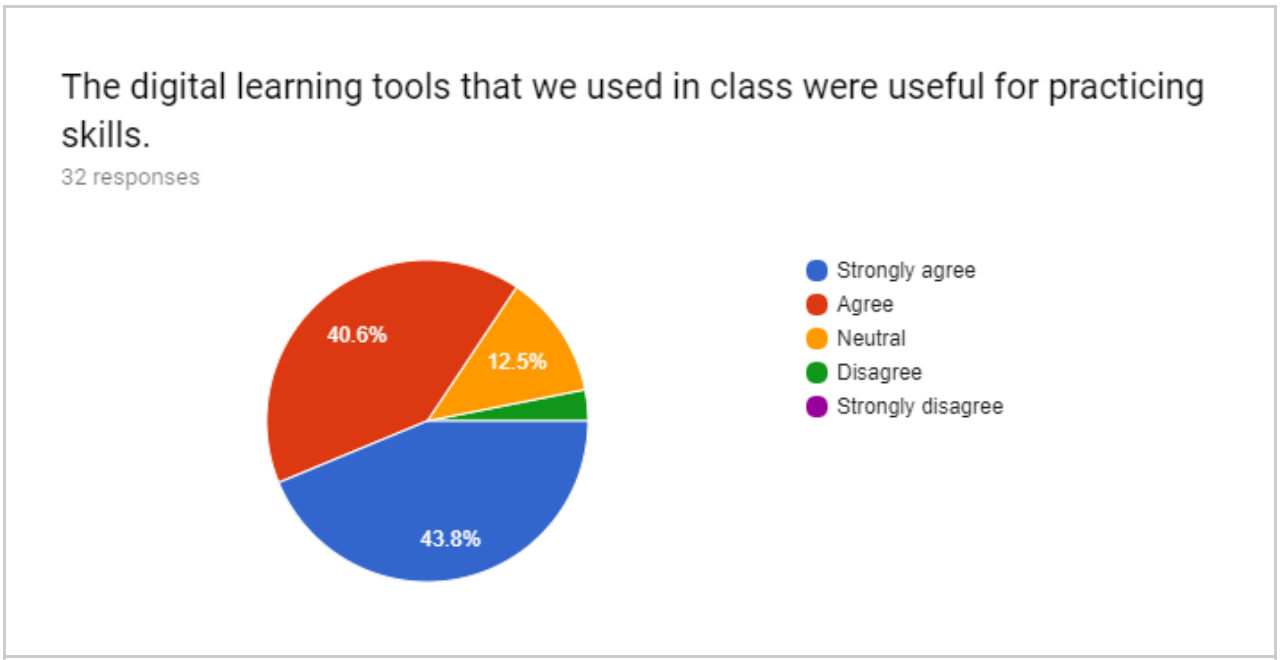

Figure 6. Practicing skills

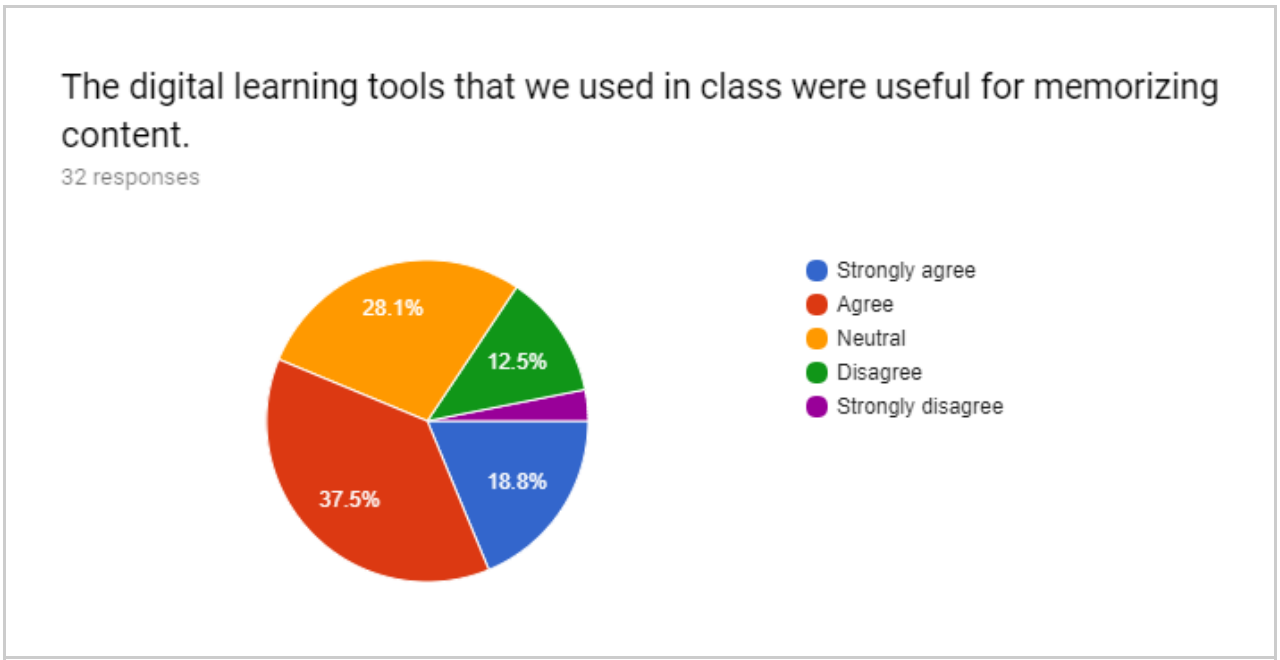

Figure 7. Memorizing content

with the tools they used, then they felt that they were more likely to be successful. At the outset of the semester, 81.3% believed they could be successful and even outperform their previous year. Most tasks were being delivered via Google Classroom and the other apps bundled in GAFE. In regards to ease of use, 96.9% of the participants agreed that Google Classroom was easy to use right away, that the learning curve was short and not too steep (34.4% agreed and 62.5% strongly agreed). Only one student felt neutral on the topic and none disagreed.

As stated, at the beginning of the semester, over 80% of the participants believed they could be successful. Compare this to the 64.6% that reported this efficacious feeling mid-semester. During the semester, over 50% of participants reported having a genuine interest in the three subject areas and, at the semester's end, that number hadn't changed significantly: exactly 50% agreed that the content was genuinely interesting. This was especially interesting when considering that the end-of-semester positive-response group didn't entirely consist of the same members as the mid-semester group. Some students said they had lost their interest while others reported having suddenly gained an interest. Student C wrote, "I find that most of the time I am not learning because I wanted to learn but I'm rather just learning because I'm being told to." But Student J wrote, "I have felt a sense of ownership over my learning. I always want to learn, even though I don't like learning that much." This suggested a factor at play that was impacting some students negatively and others positively. Teacher D wrote, "I think that once they understood the value in what we were doing, some students took ownership and began to run with the content." There seemed to be some support for this notion in the collected responses. On the other hand, Teacher B wrote,

> I reinforce this regularly that they have the opportunity to turn their failures into successes and to extend their learning. I make it clear that they are 100% in

charge of their final grade. The struggle is that they naturally default to not working as hard as they could all of the time.

So, this dichotomy appeared to exist in both participant groups.

Given that many participants described a stressful workload, it may be possible that the logistics of learning in a digital environment weren't as helpful for everyone as was originally assumed. "It's very frustrating when teachers assume that we can get things done so fast, or if we have project in every class and have no time to work on them in class and teachers don't give us the benefit of the doubt that we are stressing out." Perhaps the discomfort that was brought on by stress negated any feelings of comfort provided by a familiar work environment - they may not have been enough. Conversely, those students that maintained or even said that they have developed an interest in the course content may have utilized the features of Google Classroom that helped them to manage this workload, thus it is possible that, in *this* case, the feelings of comfort negated those of discomfort.

Ownership of learning appears not to be directly affected by digital learning tools. The results of the survey indicated that feelings of engagement and self-efficacy were perceived by students when digital tools were a fundamental piece of the classroom and of their learning. When asked if the apps used in class or the learning management system (LMS) in which projects were delivered had a direct effect on their ownership of learning, participants reported a perception that engagement and self-efficacy increased but that their ownership remained unaffected.

Despite comments denying an increase in ownership, some learners described an increased sense of value around the curriculum and pointed out that it seemed relevant. However,

this perceived increase did not appear to be directly related to the use of digital learning tools. Teacher B writes,

> I am not sure that there is a direct connection. From my experience, the connection or motivation is related to the actual purposefulness of the activity. Digital or otherwise, if students have no idea why they are doing the activity, or if they cannot see a connection to their lives then they have no interest in doing it.

Instead, it seemed that ownership was born out of engagement (a sense of interest and relevance), and efficacy (the belief in one's ability to succeed). Once those were established, learners reported a perception of the qualities that define ownership.

Participants suggested that GAFE was the leading factor in the development of engagement and self-efficacy and indirectly fostered ownership of learning. Only 1 participant indicated that GAFE did not make it easier to stay motivated in class. There were 16 participants who reported no change, which suggests that they felt their engagement was adequate with or without the apps. But 15 students attributed their motivation in class to GAFE (34.4% agreed and 12.5% strongly agreed). This alone did not suggest ownership of learning, but responses to the question of GAFE's impact on motivation *outside* the classroom began to suggest it. One participant still maintained that GAFE was not impacting his motivation, but now 65.6% of the participant group accredited GAFE for their level of motivation on their own time (37.5% agreed and 28.1% strongly agreed), explaining that its ease of use and familiar functionality and aesthetics made it easier to care about what they were doing. One might wonder if other factors also impacted these feelings, which is certainly valid. However, 65.6% of the participant group agreed that GAFE played a *key* role in their motivation to succeed. It is fair to conclude, based on these responses, that most students who used GAFE in this case study experienced an increase in

engagement and self-efficacy, especially outside of the classroom, when factors such as teachers' reminders and usual physical environment aren't present. However, it may be too far a stretch to suggest, based on these findings, that ownership is linked to the use of digital learning tools.

Ownership of learning is not linked to study habits. Some level of ownership of learning at the beginning of the semester was expressed by 40.7% of the participants, indicating that they frequently extended their learning beyond the classroom, on their own time. As mentioned, it is important to note the difference in perspective on this matter: student and teacher perceptions differed. This personal pursuit of knowledge, of understanding, and of skills is precisely the quality educators at this school are hoping to instill in their learners.

Similar to those reporting ownership of learning, 46.0% of students expressed that their study habits were exceptionally good at the outset of the semester. It was interesting, though, that only 34.4% of the participants were included in *both* of those groups. It cannot, therefore, be gleaned that a link between study habits and ownership of learning necessarily exists. Some students were active and studious learners but didn't develop a sincere interest in content or pursuit of understanding. And for others, it seemed, a genuine interest in the subject material did not, on its own, serve as motivation to achieve academic success. Instead, it seemed to be learners who began to understand the value and/or practical use for what they were learning who expressed a sense of ownership - they wanted to know more. But learners who failed to understand the value checked out or were simply "going through the motions" as one participant put it.

Teachers expect too much from students and may be overworking them. Fast technology seemed to encourage teachers to expect fast work. Learners felt as though technology increased the pace of the semester. "I feel like I don't understand the content that

much because of the fast-paced learning and having so many different assigned crammed into such little time. I feel that slow-paced learning will focus more on understanding and less on covering the content just because it needs to be covered" (Student I). Student Ee expressed concerns over the number of projects that were assigned in a very short time frame.

> We started a project say on monday its due on friday and then we are starting another project that very same day and the it would be due on tuesday. We have no room to take a deep breath and just have fun for once in our lives. MY weekends are filled with homework and not because I didn't do it because we have project on top of project and not having anytime to take a breath and let some of us catch up.

It became clear that, although modern technology has made it easier to quickly design projects filled with content and tools that students find interesting, it has in this case also quickened the expected rate of completion. Faster may not be better when engagement, efficacy and, ultimately, ownership of learning, appear to decrease.

Summary

The results of the survey have not only provided numeric information around student perception of engagement, self-efficacy and ownership of learning, but they have revealed possible connections between these feelings and the use of digital learning tools in the classroom. The following section discusses these findings in the context of the six emergent themes and by comparing the findings to past research.

Discussion

This section reflects on past research that has been conducted in this area, comments on the results of this survey, and synthesizes the two in order to confirm or refute my initial assumptions around technology integration. Implications of this research are presented and areas which might require further exploration are identified. Ideas for future research are also presented. When I first considered the impact that digital learning tools would have on students, when used extensively as part of regular classroom routines, I assumed that learner engagement, self-efficacy, and ownership of learning would increase. In some ways, I was correct, but in other ways I was not.

Current research has suggested that a link between technology-use and increased student engagement exists. The repeated use of digital learning tools breeds familiarity, especially when adequate training is provided, and this boosts engagement (Akkan, et al., 2012). It is also plausible that the introduction of a *new* technology will cause learners to be more engaged in the classroom (Wu, Hsu, & Hwang, 2008). The results of this survey revealed that at the end of the semester, after using digital learning tools extensively, nearly half of student participants felt they were engaged in class. Of that group, half of the participants attribute their engagement to the relevancy provided by a digital approach to learning. This supports the findings of past research but certainly not on a large scale. Future studies might seek a larger participant group, perhaps recruiting groups from multiple schools to gain a broader perspective. Teacher participants felt that student engagement was slightly higher at the end of the semester than at its beginning, however, this increase was so negligible, only softening the degree by which teachers felt students were disengaged, that it can hardly be considered supporting evidence. Future studies might consider providing participants with a more specific definition of the term

engagement to eliminate the possibility that these contrasting results were due to a misunderstanding of terminology.

Student participants reported that they felt a sense of self-efficacy because the tools made much of the work more approachable, resulting from being in a familiar and comfortable learning environment and because many tasks that were previously cumbersome or time consuming were now simple and efficient. Not one student participant felt that learning to use new technology was difficult or frightening and more than half believed they could be successful academically. According to Rovai and Jordan (2004), educational designs that make use of technology extensively require learners to be self-motivated, to possess the ability to work without hesitation or inhibition. But Collins (1999) indicates that a fear of technology often prevents learners from believing in their ability to succeed. He suggests that feelings of self-efficacy are established by creating a learning environment that is familiar to students. While it cannot be said for certain, it is highly likely that the familiarity and efficiency that digital learning tools provided aided in creating feelings of self-efficacy.

My assumption that digital learning tools would encourage students to develop ownership of learning, a sincere desire to learn for the sake of learning was based on previous research. Yasar Akkan, Bulent Guven, and Unal Cakiroglu (2012) suggest that technology could have a positive effect on student ownership. This notion is supported by Goodwin and Miller (2013) who say a sense of freedom that boosts the desire to learn is brought on by the use of technology in the classroom. In this study, teacher responses did not support Goodwin and Miller's notion. Ownership of learning may instead be "related to the actual purposefulness of the activity. Digital or otherwise" (Teacher B). Additionally, some students felt that they had taken ownership of their learning but they did not attribute that directly to the use of digital learning

tools. Others felt they had lost a sense of ownership, but they too did not attribute that to the use of digital learning tools. Instead, a student's ownership of learning appears to depend on two factors: the value or relevance of the subject material, and their personal interest in the subject material. Perhaps future research might investigate if a link between technology and relevancy of content can be found. If so, it may stand, as past research suggests, that technology-use promotes ownership of learning, albeit indirectly.

Additionally, it was noted that students' ownership of learning may develop alongside their desire to succeed academically by introducing technology as a regular classroom component (Jain & Getis, 2003). Evidence of this parallel development was not identified while analyzing participant responses. It appeared that only 34% of student participants felt that they had taken ownership of their learning and that their study habits were indicative of an academically motivated learner. Teachers reported even lower perceptions of student study habits, so a link between ownership of learning and a studious nature could not be confirmed.

It has been proposed that technology simplifies logistical processes, making it easier for students and teachers to interact and conduct their work. Merz (2010) and Ehrhardt (2010) claim that modern technology not only simplifies traditional collaborative methods, but that it also presents exciting new opportunities for collaboration on a global scale, breaking the barrier of isolation that has existed in education for so long. Similarly, a greater level of accountability is attained when larger and farther-reaching public audience is accessed through technology. Schools may invite community members (local and global) to become stakeholders in classroom projects (for an example see Halverson, Grigg, Prichett, & Thomas, 2007). Both student and teacher participants reported a love for the simplicity and efficiency that digital learning tools bring to education. Google Classroom and the Google Apps for Education (GAFE) suite have

been key contributors. However, the ease and speed that digital learning tools provide appears to have had an unforeseen negative impact on learners' experiences. From the student perspective, teacher expectations around scale and quality of work have risen, and timelines in which the work is expected to be completed have tightened. According to students, this has, at times, created a stress-filled environment, making it difficult for learners to maintain feelings of self-efficacy and engagement. So, it seems that the study confirmed notions presented by past research, that digital learning tools simplify the logistics of education. However, future researchers may wish to examine the impact that this efficiency has on classroom expectations and project timelines. One might also investigate whether or not these perceptions are shared by other schools with different demographics.

Implications

The purpose of this study was to help teachers at the focus school and other similar schools to make informed decisions around technology integration. If educators are trying to develop engaged, efficacious, and inquisitive learners, and if their plan is to use technology to accomplish that goal, then this exploratory case study could prove to be a beneficial reference.

The apparent trend in participant responses, particularly student responses, suggested that engagement and self-efficacy were impacted by the adoption of digital learning tools in classrooms. Past research supports this observation (Wu, Hsu, & Hwang, 2008; Sahin, 2011; and Akkan, et al., 2012), but the participant group for this case study was likely not large enough to recognize any real growth in engagement and self-efficacy. It is conceivable that schools with greater enrollment, and with a similar financial investment when adopting a model similar to the focus school's, may demonstrate statistically significant findings, and would benefit from quantitative data collected from a larger participant group. For these reasons, if this study were

to be repeated or perhaps replicated elsewhere, it would be advisable to recruit a larger participant group.

The most impactful tool, according to participants, was the use of a learning management system (LMS) as a hub for digital classroom activity. I am curious if the specific LMS that was used might impact the results of the study. Since the purpose is to help teachers and administrators make informed decisions, and since it appears that LMS's are beneficial to learners, it naturally follows that one might wish to know *which* LMS is best. There are many LMS's commonly used in flipped or blended classrooms, only one of which was used in this case study. If conducting the study a second time, these factors would be considered.

The survey results seemed to suggest that there was very little connection, if any, between digital learning tools and ownership of learning. Which did not align with past research. Yasar Akkan, Bulent Guven, and Unal Cakiroglu (2012) found that technology helps to foster ownership of learning, but the results of this exploratory case study could not support their findings. This difference may be unique to this case, so it would be enlightening and highly beneficial to replicate this study at other schools in the Abbotsford school district or even elsewhere in British Columbia.

Recommendation

The decision to use Google Classroom and the GAFE suite at the focus school is sound. Based on the results of this survey, students communicated that they feel comfortable in the environment that it creates, which appears to breed self-efficacy, which learners say, then leads to engagement. The applications that teachers choose to use as digital learning tools in their classrooms, however many or few, will have a variety of effects across a multitude of learners. Some apps will prove successful to a wide range of students, while others may be effective for

one individual. And, as participants described their experience with Powtoon, some apps may fail altogether. The one thing that nearly every participant in this study reported is that learners prefer to experience all of this in one place. A learning management system like Google Classroom does just that. There will certainly be features that are more useful than others and those might change with each new group of students that is brought into the pod system; while this study was being conducted, three Grade 10 pods were in session, totaling 86 students. In any case, learners need a place of familiarity that caters to their modern logistic requirements.

I would recommend that the focus school in this study continue its mandate that all courses will utilize the GAFE suite, specifically that all courses will use the LMS Google Classroom. The opportunities for collaboration across all GAFE-branded apps, and the potential benefit that students will become more engaged and efficacious learners far exceeds the minimal negative implications that have been reported by participants in this study.

Limitations

Most of the participating students were enrolled in a similar, cross-curricular pod during the previous semester. To be exact, 28 students were enrolled in the previous year's pod while 4 were not. Students had already spent one semester in the Grade 9 pod, where they became familiar with many of these tools and procedures. They were already familiar with working in a digital environment. They were even enrolled in a digital citizenship class where they were exposed to many of these tools and taught how to use them effectively and efficiently. They were shown how to find new tools so that each student would be able to access the right one for the job, so to speak, which would account for the confidence students felt with technology at the outset of this semester. It might be more valuable to contrast this against a group that, prior to beginning this semester, has had no experience using digital learning tools. One might wish to

survey a control group, at the same stage in their semester, that has not used any digital learning tools in the classroom.

Also, participants were asked to reflect on their semester in one sitting. The survey questions addressed three moments in time: The beginning of the semester, during the semester, and at the semester's end. This was a convenient and efficient way to collect responses from the group but hindsight suggests that an alternative method may have been more accurate. Participants may have been reflecting on their semester through rose-coloured glasses, so to speak, feeling relieved that the work is over and perhaps excited that the next semester is about to begin, which may have influenced their responses. The reflections may have been more accurate if delivered at specific checkpoints across the semester. Participants might have responded to the first set of questions during the first week of the semester, then the second set at the mid-term point, then the final set at the end of the semester. Unfortunately, research approval was not granted in time to begin recruiting prior to the start of the semester.

Additionally, the sample group might be considered relatively small. Although 86 learners were recruited, only 32 chose to participate. While their responses did provide sufficient information to begin to understand perceived levels of engagement, self-efficacy and ownership, the results did not reach a point of saturation. One avenue for continuing this research would be to conduct another round of recruiting, perhaps at a similar school, to increase the number of participants. This may confirm some of the themes that were identified in this study. It would also broaden the perspective to include students and teachers from other demographics. Alternatively, the sample group for this survey could have been expanded by beginning the recruiting process earlier in the semester so that students and staff would have ample time to consider participating.

It must also be considered that external factors may have impacted learners' experiences with digital learning tools. Thus, it is possible that some responses have been tainted and may not accurately represent a participant's views. For example, one student participant's family sold their home during the semester. There was a period of a few weeks that involved packing, moving and then unpacking at their new home. For a period, wifi was not available at home. "When I was moving it was hard to find time time to go to the library everyday just for WiFi." This participant's experience and opinion of the digital environment differs from many of the others, but for reasons that don't exist within the the other participants' contexts.

A similar concern could be raised for students whose families allow for less screen time at home. One participant may have no technology-usage limitations at home, while another might only be allowed an hour per day. This is speculative as these issues were not addressed in the survey questions.

The student and teacher surveys weren't similar in their design, which made it difficult to use the teacher responses for their intended purpose. To clarify, the questions in the teacher survey were not parallel to those in the student survey. The teacher participant responses were designed to provide an alternate perspective against which to hold the student participant responses. The coding and analysis process was made more challenging than necessary as a result. If the teacher survey were to be redesigned, it would be valuable to align the questions, so that for every student question there is a similar teacher question.

Future Research

The primary purpose of this study was to provide the focus school and its district with insightful information that might be helpful when deciding which digital technologies will be incorporated and which will not. The study may also provoke new ideas and inspire educators to

expand on the research, taking it in new directions. Three ideas for future research are presented below.

Isolation in education. There is a history of isolation in education. "Parents and members of the business community were kept politely at arm's length, invited to contribute to class processes now and again but essentially isolated from the real work of education" (Merz, 2010). This isolation could play a significant role in the lack of ownership that modern learners feel regarding their education. To enhance ownership of learning, Merz (2010) indicates that the audience for which learners demonstrate their understanding of curriculum and their ability to synthesize and apply skills should be expanded to include community members and parents. She describes the communities for which students demonstrate their work as school learning communities (SLC's), and professional learning communities (PLC's):

> Both PLCs and SLCs can be designed to include parents and educators working together to build partnerships for student achievement. Parents and teachers must partner in SLCs to build the high social capital that is known to have a positive impact on student achievement. All schools would do well to engage parents in PLCs around increased student achievement, through both in person sessions and online venues. (Merz, 2010, p.52).

Merz identifies the benefits of instructional design that includes online learning environments. Educators ought to include parents, and include the school and community professionals as authentic audience members to witness, benefit from, and provide feedback for our learners. Perhaps a link between digital learning tools and ownership of learning exists in those tools that focus on collaboration. Future research on the impact of digital learning tools could focus

specifically on those tools that seek to desegregate learners and to break the figurative walls of education by inviting external audiences to provide feedback.

Measuring study habits. This study revealed that participants' perceptions of student study habits differed, depending on the participants' perspectives. To be specific, many students believed that they demonstrated exceptional study habits during the semester, and very few students believed their study habits were poor. In contrast, however, every teacher participant felt that, in general, students' study habits were exceptionally poor during the semester. This begs the question, what does it mean to have *good study habits*?

If this study were to be replicated, researchers might decide to introduce digital learning tools that are designed to help with study habits. Applications such as graphic organizers, calendars, reminder apps, digital flashcards, text-to-speech readers, and others could be introduced and their classroom use monitored. If academic scores were also recorded, providing quantitative data, then classroom observations of application-use might be observed and synthesized with academic scores so that researchers might begin to understand their relationship. This would reveal and perhaps quantify any discrepancies between learner's perceived study habits and their academic success. For example, one learner may feel that he or she is working hard to learn the content but may yield low academic scores, resulting in decreased efficacy and decreased engagement. This future research could serve as an extension of the current study.

Once size doesn't fit all. The student survey asked participants to identify their least favorite digital learning tool that was used in the semester. A third of the participants identified Powtoon as their least favorite. A similar question asked participants to identify any applications that hindered their learning. Once again, nearly a third singled out the application

Powtoon. The disdain for this app was expressed colourfully at times which, while humorous, made it very clear that for this demographic, Powtoon was not an appropriate addition to the application arsenal. It makes one wonder, though, how students at another school might respond.

As stated in the methodology section, this case study is quite unique in its context. The students at the focus school have been immersed in classroom technology for over one year and they are bound for enrollment in next year's school-within-a-school programs: the school of business or the school of science. Arguably, students at the focus school would respond differently to an animation application like Powtoon, than students from an arts-specific school. Business and science-minded learners might be keen to use digital learning tools that focus on simplification, efficiency, and organization, as explained in this paper's results section. Learners who favor the arts over science and business may be more inclined to spend time learning to use Powtoon effectively because the aesthetic presentation of information that the app provides might be considered rewarding. Therefore, if this study were to be replicated elsewhere, the findings may differ from those presented in this study. Future research could examine and compare the acceptance and perceived levels of effectiveness of digital learning tools across a variety of demographics.

Conclusion

This study was based on one specific and unique group of learners. While the results can benefit any school or district that is considering making changes to its current digital infusion mandates, these results are specific to learners in one educational context and are not necessarily universally true. Others may wish to replicate this study or modify it to examine their own unique learner group.

The important message from this study is that assumptions cannot be made about student engagement, self-efficacy and ownership of learning. Student voice and choice are often mentioned in teacher training programs and as themes in professional development. In these cases, the terms refer to giving students options when it comes to project completion and writing topics. Simply put, voice and choice usually refer to student freedom on assignment details. How often, though, are students given the chance to offer their voice on education's grander scale? How often are learners given the choice to navigate content in a way the best suits them? These questions aren't meant to suggest that learners are *never* granted these opportunities. However, it may be necessary to conduct more studies like these so that, by contributing, our students feel a sense of control over their education, a sense of comfort with their learning environment, and a desire to learn for the sake of learning - something that, according to these results, learners seem to enjoy.

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Appendix A

An information letter was emailed to potential teacher participants as part of the recruiting process. The version included here was linked to the opening screen of the survey, hence the instruction at the end of the letter mentions "click next" which refers to a button found on the digital survey.

Information Letter for Teacher Participants

Title: An Exploratory Study of the Impact of Digital Learning Tools on Student Engagement, Self-Efficacy, and Ownership: Insights from Teachers and Students in a British Columbia High School

Researcher(s): Dennis Neufeld, Master's Student, Memorial University of Newfoundland - djn645@mun.ca

Supervisor(s): Gabrielle Young, Assistant Professor, Memorial University of Newfoundland - gabrielley@mun.ca

Kathy Snow, Assistant Professor, Cape Breton University - Kathy_snow@cbu.ca

You are invited to take part in a research project examining *An Exploratory Study of the Impact of Digital Learning Tools on Student Engagement, Self-Efficacy, and Ownership: Insights from Teachers and Students in a British Columbia High School.*

This form is meant to inform you of the project's purpose. It should give you the basic idea of what the research is about and what your participation will involve. It also describes your right to withdraw from the study. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. Take time to read this carefully and to understand the information given to you. Please contact the researcher, Dennis Neufeld, if you have any questions about the study or would like more information before you consent.

It is entirely up to you to decide whether to take part in this research. If you choose not to take part in this research or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

Introduction:
My name is Dennis Neufeld. I am currently pursuing my Master's degree at Memorial University of Newfoundland in the Faculty of Education. As part of my Master's degree, I am conducting research under the supervision of Gabrielle Young at Memorial University of Newfoundland and Kathy Snow at Cape Breton University.

Purpose of Study:
You may have noticed an increase in the amount of digital technology that is used in classrooms over the past few years. It is no secret that many schools promote the use of these technologies, hoping that students will remain interested in learning and that these tools will help them be more successful in school. By conducting this study, I hope to get student and teacher perspectives on their own experience with technology in the classroom so that, in the future, teachers, schools, and school districts will understand how some of these tools help students become motivated learners learn while others might distract from learning or be otherwise ineffective.

What You Will Do in this Study:
If you decide to participate in this study, you will complete an online survey that is made up of open-ended questions as well as multiple-choice questions.

Length of Time:
The survey will take between 20 and 30 minutes to complete and should be done in a single sitting.

Withdrawal from the Study:
- The data collected in this survey is completely anonymous.
- If, while you are completing the survey, you decide that you do not wish to participate in this study, then you must not click "submit" and simply close your web browser. Upon doing so, your responses and any data collected will be removed from the record.
- If you have already completed the survey and have clicked "submit", then the data has already been collected and there is no way to remove it. However, the collected data is completely anonymous.

Possible Benefits:
a) If you are a student at Rick Hansen Secondary, then it is likely that the data collected will assist your future teachers as they design their courses to include modern digital learning tools so that you may be more engaged in your education.
b) If you are a teacher at Rick Hansen Secondary, then the data collected may help you make informed decisions about which digital learning tools help to engage students and help them develop ownership of their learning.

c) The scholarly community may benefit if future studies refer to the collected data for insight or to compare results from alternative demographics.

Possible Risks:
There are no physical or financial risks to participants of this study.

Some students may feel that, since I am their teacher (currently or previously), their participation in this study is a criticism of me as an educator. Please be reminded that this study is completely anonymous and that any data collected cannot be connected to individual participants.

Some teachers may feel that, by participating in this study, they are acknowledging that their integration of digital learning tools was not sufficient. Please know that this study is not a criticism of current practice, instead it is intended to provide insight on the used of educational technology for the future benefit of students and teachers.

If participants (students or teachers) experience extreme emotional or social discomfort as a result of this study, then they will be referred to our school counseling office.

Confidentiality:
The ethical duty of confidentiality includes safeguarding participants' identities, personal information, and data from unauthorized access, use, or disclosure.

Participants for this research project will be selected from Rick Hansen Secondary School, and many of you know each other. As a researcher, I will undertake to safeguard the confidentiality of participants. As participants, I ask that you respect the confidentiality of others by not disclosing the contents of your survey responses with teachers or students.

Anonymity:
Anonymity refers to protecting participants' identifying characteristics, such as name or description of physical appearance.

All data collected during this study will remain completely anonymous. However, while this information cannot be connected directly to the anonymous data that is collected, due to the limited number of potential teacher participants, anonymity is limited.
Please note that every reasonable effort will be made to ensure your anonymity, and you will not be identified in publications arising from this data.

Use, Access, Ownership, and Storage of Data:
- All data will be stored in an encrypted, password-protected file.
- During the collection process, data will be stored in an encrypted file on Google servers (see "Third-Party Data Storage" section below). After collection is complete, the file will be removed from Google servers and will be stored an external hard drive that will remain disconnected from any computer when not in use.

- The principal researcher, Dennis Neufeld, will have sole access to the collected data. The supervisor and a graduate student will be invited to review portion of the data, which will be shared in a encrypted, password-protected file.
- This data will be kept for a minimum of five years, as required by Memorial University's policy on Integrity in Scholarly Research.

Third-Party Data Collection and/or Storage:
Data collected from you as part of your participation in this project will be hosted and/or stored electronically by *Google* and is subject to their privacy policy, and to any relevant laws of the country in which their servers are located. Therefore, anonymity and confidentiality of data may not be guaranteed in the rare instance, for example, that government agencies obtain a court order compelling the provider to grant access to specific data stored on their servers. If you have questions or concerns about how your data will be collected or stored, please contact the researcher and/or visit the provider's website for more information before participating. The privacy and security policy of the third-party hosting data collection and/or storing data can be found at:
https://cloud.google.com/storage/docs/gsutil/addlhelp/SecurityandPrivacyConsiderations

Reporting of Results:
The data collected during this study, and the conclusions that may be drawn will be submitted for peer review and published through Memorial University's thesis repository. The data collected will remain anonymous at all times.
When the study is complete and has been published, findings will be made available on the Rick Hansen Secondary school website and will be provided to grade 10 classes in the form of an information document that summarizes the results of the study.
Upon completion, my thesis will be available at Memorial University's Queen Elizabeth II library, and can be accessed online at: http://collections.mun.ca/cdm/search/collection/theses.
In my thesis, data will be presented in the form of summaries, graphic representations, and direct quotes. Pseudonyms will be used as the data will be collected anonymously.

Questions:
You are welcome to ask questions before, during, or after your participation in this research. If you would like more information about this study, please contact: Dennis Neufeld at djn645@mun.ca. You may also contact the thesis supervisors, Gabrielle Young at gabrielley@mun.ca, and Kathy Snow at Kathy_snow@cbu.ca

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research, such as the way you have been treated or your rights as a participant, you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Consent:
By completing this survey you agree that:

- You have read the information about the research.
- You have been advised that you may ask questions about this study and receive answers prior to continuing.
- You are satisfied that any questions you had have been addressed.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw participation from the study by closing your browser window or navigating away from this page, without having to give a reason and that doing so will not affect you now or in the future.
- You understand that this data is being collected anonymously and therefore your data **cannot** be removed once you submit this survey.

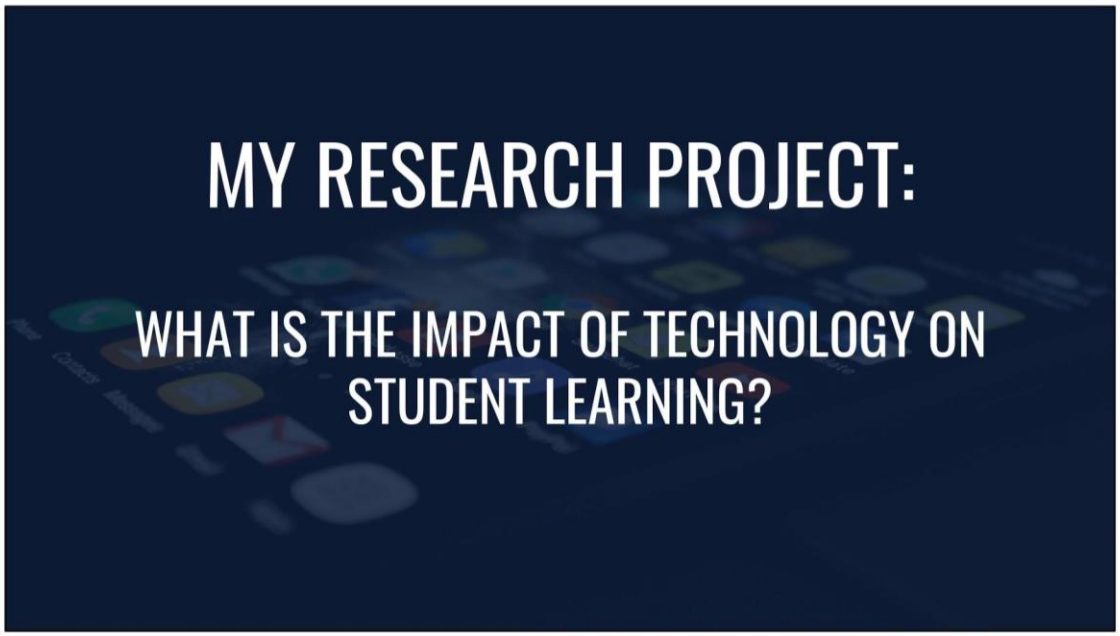
By consenting to this online survey, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Please retain a copy of this consent information for your records.

Clicking "Next" **below and submitting this survey constitutes consent and implies your agreement to the above statements.**

Appendix B

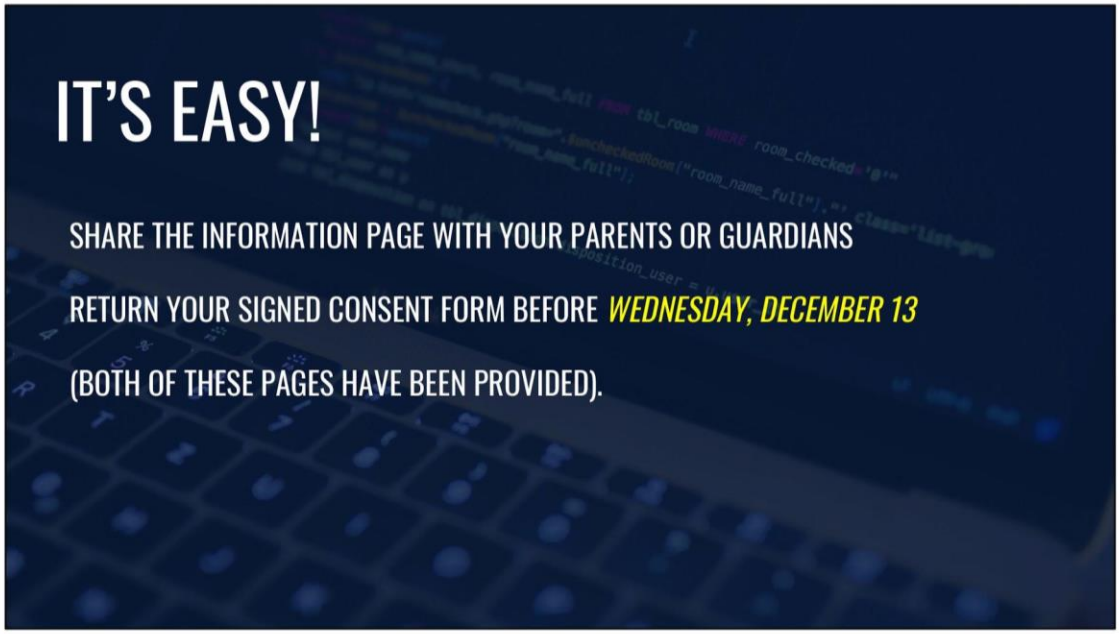
Student participant recruitment was conducted via presentation. The following text and images represent the slideshow and script that was read to potential student participants.



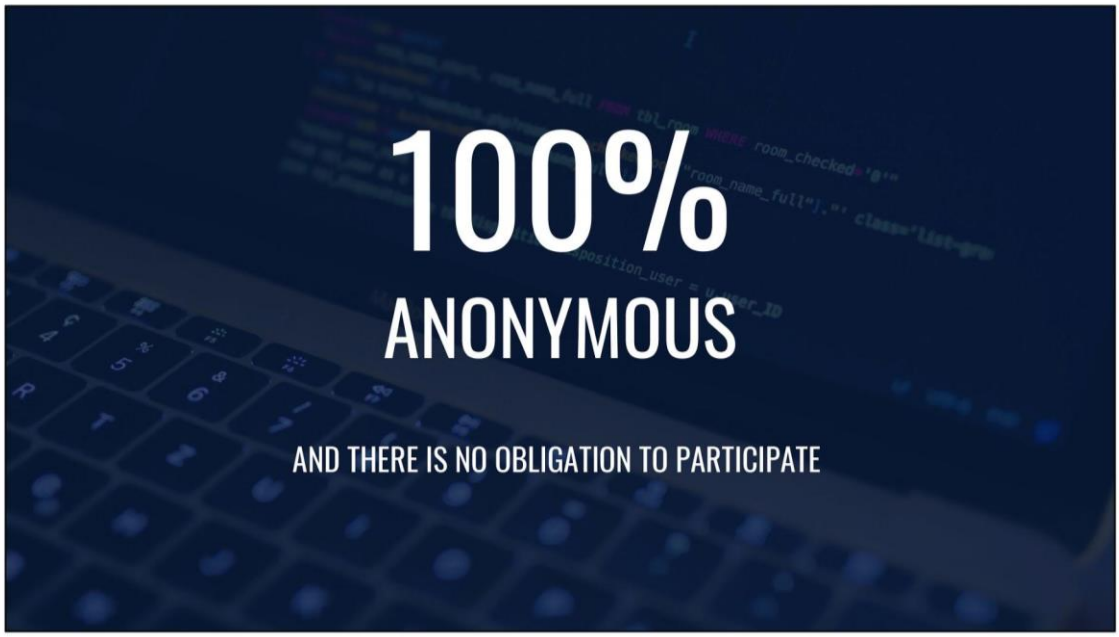
Thank you so much for taking the time to hear about my research project. And thank you (insert classroom teacher name) for carving out some time during this block. I'm currently working on my masters thesis through Memorial University of Newfoundland. This thesis is a big project that involves doing some research on a subject I'm passionate about. As you can see, my research is taking a look at the impact of technology on student learning. This is a simplified version of my project's more complex title…(next slide).

This title might look a bit intimidating but, if we define a few words, you'll see that it's not too complicated. The word "exploratory" means that I'm interested in collecting and analyzing personal responses to a topic on which there isn't much research. By "digital learning tools" I simply mean any tool that your teacher asks you to access for the purpose of learning in this course. These tools might be Google apps for education, social media, youtube, etc. When I say "student engagement" I mean your level of interest in what's being done in class. I'm wondering whether certain digital learning tools help you to become interested in course content. When I say "self-efficacy" I mean your belief in yourself as a student. I'm wondering if these tools help you to feel as though you CAN achieve success, rather than doubting your own academic ability. "Ownership of learning" refers to when you might learn for the sake of learning, rather than just to improve your grade. In other words, when you're learning because YOU want to, not just because your teacher says you need to.

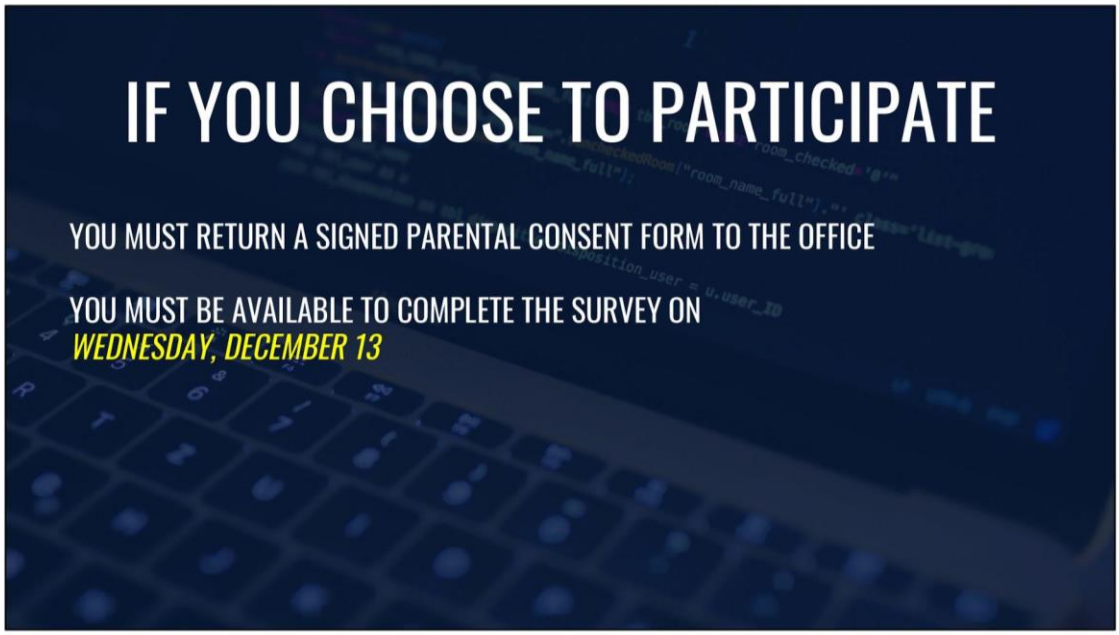
That might be a lot to absorb in just these few minutes. But the reason I'm here today is to ask if you would like to help me explore these ideas. I've prepared a survey that contains mostly multiple choice questions as well as a few short answer questions. This isn't a test and there are no wrong answers. This survey is not a school or course requirement. The survey will take place on Wednesday, December 13th here at school.



Recruiter hands out paper copies of recruiting document and parental consent form (stapled together). If you're interested, all you need to do is take the information page and attached consent form home and share them with your parents or guardians. If they decide to give you permission to participate, return the signed consent form to our office secretary. I've handed each of you these documents so that you all have the opportunity to decide whether or not you would like to participate. There is no obligation to decide right now and there is certainly no obligation to participate at all. If you choose not to participate, simply recycle the documents.



Some of you might feel a bit hesitant because I'm asking you to reflect critically about your school experience - you might feel like you're judging your teacher's methods. You should know that the survey is entirely anonymous - meaning there is no way for anyone (including me) to link your responses to your name.



As mentioned, there is absolutely no obligation to participate in this study. But, if you decide to participate, then:

You must return a signed parental consent form to the office

You must be available to complete the survey on (wed. December 13) here at school.

Are there any questions at this time? If you or your parents have any questions now, before taking the survey or even afterward, please do not hesitate to come speak with me. You can also email me at the address on the screen.

Appendix C

Informed Consent Letter

Title: An Exploratory Study of the Impact of Digital Learning Tools on Student Engagement, Self-Efficacy, and Ownership: Insights from Teachers and Students in one High School in British Columbia

Researcher(s): Dennis Neufeld, Master's Student, Memorial University of Newfoundland - djn645@mun.ca

Supervisor(s): Gabrielle Young, Assistant Professor, Memorial University of Newfoundland - gabrielley@mun.ca

Kathy Snow, Assistant Professor, Cape Breton University - Kathy_snow@cbu.ca

You are invited to take part in a research project examining *The Impact of Digital Learning Tools on Student Engagement, Self-Efficacy, and Ownership: Insights from Teachers and Students.*

This form is part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. It also describes your right to withdraw from the study. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is the informed consent process. Take time to read this carefully and to understand the information given to you. Please contact the researcher, Dennis Neufeld, if you have any questions about the study or would like more information before you consent.

It is entirely up to you to decide whether to take part in this research. If you choose not to take part in this research or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

Introduction:

My name is Dennis Neufeld. I am currently pursuing my Master's degree at Memorial University of Newfoundland in the Faculty of Education. As part of my Master's degree, I am conducting research under the supervision of Gabrielle Young at Memorial University of Newfoundland and Kathy Snow at Cape Breton University.

Purpose of Study:

NOTE: This study is **not** a school or course requirement. You may have noticed an increase in the amount of digital technology that is used in classrooms over the past few years. It is no secret that many schools promote the use of these technologies, hoping that students will remain interested in learning and that these tools will help them be more successful in school. By conducting this study, I hope to get student and teacher perspectives on their own experience with technology in the classroom so that, in the future, teachers, schools, and school districts will understand how some of these tools help students become motivated learners learn while others might distract from learning or be otherwise ineffective.

What You Will Do in this Study:

If you decide to participate in this study, you will complete an online survey that is made up of open-ended questions as well as multiple-choice questions. This survey will be done at school on Wednesday, December 13th.

Length of Time:

The survey will take between 20 and 30 minutes to complete and will be done in a single sitting.

Withdrawal from the Study:

- The data collected in this survey is completely anonymous.
- If, while you are completing the survey, you decide that you do not wish to participate in this study, then you must not click "submit" and simply close your web browser. Upon doing so, your responses and any data collected will be removed from the record.
- If you have already completed the survey and have clicked "submit", then the data has already been collected and there is no way to remove it. However, the collected data is completely anonymous.

Possible Benefits:

a) If you are a student at Rick Hansen Secondary, then it is likely that the data collected will assist your future teachers as they design their courses to include modern digital learning tools so that you may be more engaged in your education.
b) If you are a teacher at Rick Hansen Secondary, then the data collected may help you make informed decisions about which digital learning tools help to engage students and help them develop ownership of their learning.
c) The scholarly community may benefit if future studies refer to the collected data for insight or to compare results from alternative demographics.

Possible Risks:

There are no physical or financial risks to participants of this study.

Some students may feel that, since I am their teacher (currently or previously), their participation in this study is a criticism of me as an educator. Please be reminded that this study is completely anonymous and that any data collected cannot be connected to individual participants.

Some teachers may feel that, by participating in this study, they are acknowledging that their integration of digital learning tools was not sufficient. Please know that this study is not a criticism of current practice, instead it is intended to provide insight on the used of educational technology for the future benefit of students and teachers.

If participants (students or teachers) experience extreme emotional or social discomfort as a result of this study, then they will be referred to our school counseling office.

Confidentiality:
The ethical duty of confidentiality includes safeguarding participants' identities, personal information, and data from unauthorized access, use, or disclosure.

Participants for this research project will be selected from Rick Hansen Secondary School, and many of you know each other. As a researcher, I will undertake to safeguard the confidentiality of participants. As participants, I ask that you respect the confidentiality of other students by not disclosing the contents of your survey responses with teachers or students.

Anonymity:
Anonymity refers to protecting participants' identifying characteristics, such as name or description of physical appearance.

All data collected during this study will remain completely anonymous. Once the data is collected, participants can no longer be identified. However, students will need to submit a consent form signed by their parent or guardian. Having collected these consent forms, the principal researcher, Dennis Neufeld, will have a record of all who participated. No one except the principal researcher will know who has or has not participated. However, this information cannot be connected to the anonymous data that is collected.
Every reasonable effort will be made to ensure your anonymity, and you will not be identified in publications arising from this data.

Use, Access, Ownership, and Storage of Data:

- All data will be stored in an encrypted, password-protected file.
- During the collection process, data will be stored in an encrypted file on Google servers (see "Third-Party Data Storage" section below). After collection is complete, the file will be removed from Google servers and will be stored an external hard drive that will remain disconnected from any computer when not in use.
- The principal researcher, Dennis Neufeld, will have sole access to the collected data. The supervisor and a graduate student will be invited to review portion of the data, which will be shared in a encrypted, password-protected file.

- This data will be kept for a minimum of five years, as required by Memorial University's policy on Integrity in Scholarly Research.

Third-Party Data Collection and/or Storage:
Data collected from you as part of your participation in this project will be hosted and/or stored electronically by *Google* and is subject to their privacy policy, and to any relevant laws of the country in which their servers are located. Therefore, anonymity and confidentiality of data may not be guaranteed in the rare instance, for example, that government agencies obtain a court order compelling the provider to grant access to specific data stored on their servers. If you have questions or concerns about how your data will be collected or stored, please contact the researcher and/or visit the provider's website for more information before participating. The privacy and security policy of the third-party hosting data collection and/or storing data can be found at:
https://cloud.google.com/storage/docs/gsutil/addlhelp/SecurityandPrivacyConsiderations

Reporting of Results:
The data collected during this study, and the conclusions that may be drawn will be submitted for peer review and published through Memorial University's thesis repository. The data collected will remain anonymous at all times.
When the study is complete and has been published, findings will be made available on the Rick Hansen Secondary school website and will be provided to grade 10 classes in the form of an information document that summarizes the results of the study.
Upon completion, my thesis will be available at Memorial University's Queen Elizabeth II library, and can be accessed online at: http://collections.mun.ca/cdm/search/collection/theses.
In my thesis, data will be presented in the form of summaries, graphic representations, and direct quotes.

Questions:
You are welcome to ask questions before, during, or after your participation in this research. If you would like more information about this study, please contact: Dennis Neufeld at djn645@mun.ca. You may also contact the thesis supervisors, Gabrielle Young at gabrielley@mun.ca, and Kathy Snow at Kathy_snow@cbu.ca

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research, such as the way you have been treated or your rights as a participant, you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Consent:
By completing this survey you agree that:

- You have read the information about the research.
- You have been advised that you may ask questions about this study and receive answers prior to continuing.
- You are satisfied that any questions you had have been addressed.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw participation from the study by closing your browser window or navigating away from this page, without having to give a reason and that doing so will not affect you now or in the future.
- You understand that this data is being collected anonymously and therefore your data **cannot** be removed once you submit this survey.

By consenting to this online survey, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Please retain a copy of the above consent information for your records.

INFORMED CONSENT

I give consent that my child may participate in this study, conducted by Dennis Neufeld as part of a master's thesis. I have read the attached information and I understand the nature of the study, and any associated risks. I understand that my child has the right to withdraw from the study at any time prior to or during the online survey.

Participant's full name (please print): _____

Parent/Guardian signature: _____

Date: _____

Appendix D

Student Survey Questions

The phrase “digital learning tools” refers to any digital technology that is used for education. This includes Google Classroom, the Google apps suite (docs, slides, etc), websites, online quizzes, social media, web authoring tools (blogs, for example) and games.

Likert Scale

Select the term that best describes your response to each statement.

Strongly Agree - Agree - Neutral - Disagree - Strongly Disagree

Study/Work Habits (Efficacy & Ownership of Learning)

Before beginning this semester

I had very good study habits.

I frequently extended my learning beyond the classroom, on my own time.

I had a genuine interest in the subject(s) and was looking forward to learning.

I believed I could be successful in the subject(s), perhaps even perform better than in years past

During the semester

I developed very good study habits

I frequently extended my learning beyond the classroom, on my own time.

I had a genuine interest in the subject(s) and always looked forward to learning more.

I believed I could be successful in the subject(s), perhaps even perform better than in years past

Now, at the end of the semester

I have very good study habits

I plan to extend my learning beyond the semester, seeking more on my own time.

I have a genuine interest in the subject(s) and look forward to learning more.

I feel that my study habits are somehow related to the use of digital learning tools in the classroom.

I feel that my level of interest in the subject(s) is somehow related to the use of digital learning tools in the classroom.

I believe I have been successful in the subject(s), perhaps even performed better than in years past

Comprehension

The digital learning tools that we used in class

Were useful for practicing skills

Were useful for memorizing content

Helped me understand tricky concepts

Helped me access content quickly when I needed to find something we covered earlier in the semester

Digital Learning Tools Critique (Engagement)

General

The digital learning tools that we used in class worked well for their given purpose

The digital learning tools that we used in class were actually quite fun to use

The digital learning tools that we used in class were more fun than the non-digital learning tools we might have used

The digital learning tools we used in class encouraged students to collaborate with each other (they made collaborating easy).

The digital learning tools we used in class made collaboration easier than traditional, non-digital group work

Google Apps for Education

When I first started using Google Classroom, I found it easy to learn how to use it

Google Classroom played a key role in my motivation to succeed

Google Classroom made it easier for me to stay motivated in class

Google Classroom made it easier for me to stay motivated when working outside of class

The other Google apps (besides Classroom) made it easier for me to stay motivated in class

The other Google (besides Classroom) apps made it easier for me to stay motivated when working outside of class

Communication

I prefer communicating with my teacher using digital tools such as email or Google Classroom's messaging tools, rather than communicating face-to-face.

I prefer receiving feedback on assignments digitally rather than in handwritten form

I prefer receiving feedback on assignments digitally rather than face-to-face

Open Ended Questions

Please take some time to respond thoughtfully to the following questions. Try to be specific when describing your experience.

Study/Work Habits (Efficacy & Ownership of Learning)

Please describe your level of focus or distraction when beginning a new assignment, as it was before beginning this semester.

Please describe your level of motivation when beginning new projects, prior to this semester. Were you typically excited to explore a new idea or were you simply 'going through the motions' of school?

Please describe your level of motivation when beginning new projects, during this semester. Were you typically excited to explore a new idea or were you simply 'going through the motions' of school?

During this semester, did any learning tool(s) in particular help you complete assignments effectively and on time? Please explain how.

During this semester, did any learning tool(s) in particular prevent you from completing assignments effectively and on time? Please explain how.

During this semester, did you feel a sense of ownership over your learning? In other words, were you learning because you wanted to learn? Please explain.

Comprehension

How well do you feel you understand the content of your courses this semester?

Did digital learning tools play a role in your success or lack of success this semester? Please explain.

Digital Learning Tools

This semester, Google Classroom was used as a hub for all our assignments and projects. They were distributed and resources were provided; you turned them in and received feedback, all in a digital setting. Do you think this digital approach is effective? Please explain.

Which digital learning tool was your favorite to use this semester? Please explain.

Which digital learning tool was your least favorite to use this semester? Please explain.

Which digital learning tool was the most helpful this semester? Please explain.

Which digital learning tool was the least helpful this semester? Please explain.

Communication

This semester, you experienced a blend of face-to-face and digital communication with your teacher. Do you think an effective blend was achieved or do you feel that the focus needs to be shifted? Please explain.

Appendix E

Teacher Survey Questions

The phrase "digital learning tools" refers to any digital technology that is used for education. This includes Google Classroom, the Google apps suite (docs, slides, etc), websites, online quizzes, social media, web authoring tools (blogs, for example) and games.

Likert Scale

Select the term that best describes your response to each statement.

Strongly Agree - Agree - Neutral - Disagree - Strongly Disagree

Learning Curve

I typically consider myself to be "tech-savvy" (comfortable with digital technology)

I had an easy time familiarizing myself with the digital learning tools that I decided to use in my classroom

I received lots of help from colleagues when first introducing digital learning objects into my classroom

I provide lots of help to my colleagues as they introduce digital learning objects into their classrooms

Digital Learning Tools Used in the Classroom

I regularly use a learning management system (LMS) such as Moodle or Google Classroom

I regularly use social media applications and websites such as Twitter, Instagram or Facebook

I regularly use online quiz applications such as Kahoot or Quizlet

I regularly use digital collaboration tools that allow multiple users to edit a single element such as a document, presentation or drawing

I regularly use video games or online activities

Perception of Students

At the beginning of the semester

My students appeared to be quite “tech-savvy” (comfortable with digital technology)

My students appeared to have very good study habits

My students fluency with digital technology extended beyond social media applications and mobile video games

My students seemed to have an easy time learning to use the digital learning objects in my classroom

My students seemed to enjoy using digital learning objects

At the end of the semester

My students appear to be quite “tech-savvy” (comfortable with digital technology)

My students fluency with digital technology extends beyond social media applications and mobile video games

Comprehension

The digital learning tools that we used in class

Were useful for practicing skills

Were useful for memorizing content

Helped my students understand tricky concepts

Helped my students access content quickly when they needed to find something we covered earlier in the semester

Digital Learning Tools Critique (Engagement)

General

The digital learning tools that we used in class worked well for their given purpose

Students seemed to find the digital learning tools quite fun to use

Students seemed to find the digital learning tools more fun than the non-digital learning tools we might have used

The digital learning tools we used in class encouraged students to collaborate with each other (they made collaborating easy).

The digital learning tools we used in class made collaboration easier than traditional, non-digital group work

Google Apps for Education (if applicable)

Google Classroom played a key role in student motivation to succeed

Google Classroom made it easier for students to stay motivated in class

Google Classroom made it easier for students to stay motivated when working outside of class

The other Google apps made it easier for students to stay motivated in class

The other Google apps made it easier for students to stay motivated when working outside of class

Communication

Students seemed to prefer to communicate with me using digital tools such as email or Google Classroom's messaging tools, rather than communicating face-to-face.

Students seemed to prefer receiving feedback on assignments digitally rather than in handwritten form

Students seemed to prefer receiving feedback on assignments digitally rather than face-to-face

I prefer delivering feedback on assignments digitally rather than in handwritten form

I prefer delivering feedback on assignments digitally rather than face-to-face

Open Ended Questions

Please take some time to respond thoughtfully to the following questions. Try to be specific when describing your experience.

Classroom Design

How would describe your classroom design? For example, you might describe your classroom as being "blended," "flipped," "traditional," or any other label. Please explain the qualities that lead you to use this label.

Student Study/Work Habits (Efficacy & Ownership of Learning)

Please describe the level of focus or distraction your past students had when beginning a new assignment, as it was before introducing digital learning tools in your classroom.

Before introducing digital learning tools in your classroom, what was the level of motivation like when beginning new projects. Were students typically excited to explore a new idea or were they simply 'going through the motions' of school?

During this semester, did any learning tool(s) in particular help your students complete assignments effectively and on time? Please explain how.

During this semester, did any learning tool(s) in particular prevent your students from completing assignments effectively and on time? Please explain how.

During this semester, did your students appear to feel a sense of ownership over their learning? In other words, were they learning because they wanted to learn? Please explain.

Digital Learning Tools

Do you think that using an LMS such as Google Classroom or Moodle is an effective approach to content/assignment/project delivery? Please explain.

Which digital learning tool was your favorite to use this semester? Please explain.

Which digital learning tool was your least favorite to use this semester? Please explain.

Which digital learning tool was the most helpful for students this semester? Please explain.

Which digital learning tool was the least helpful for students this semester? Please explain.

Appendix F

Coding: List of Major Themes

During the coding process, a list of major themes emerged. As per Creswell's (2012) guidelines for coding research data, a goal was set to conclude the coding process, having identified between 5 and 7 major themes. The following list contains those themes and a few sample responses for clarification:

1. Digital learning tools increase perceived engagement, but can become a distraction.
    - A student explains why he prefers digital tools over non-digital tools: "It feel it is better than non-digital. Non-digital you tend not to really care about but feedback digitally just has more of scare behind. What I'm trying to say is that when I get feedback digitally I understand it more and I tend to care about it more."
    - A teacher participant's response when asked if any digital tool became problematic for learners: "Internet. Distracting students with non-relevant information. They would rather google the answer and copy paste than think for themselves."
2. The logistics of a digital environment provide operative ease and increase a sense of self-efficacy.
    - A teacher comments on digital learning environments: "The Google apps helped lots. Everything was available to students all the time. Accessing content or tasks was never a burden."
    - A student comments on digital learning environments: "I think the digital learning tool that was most helpful was google classroom. This is because the due

dates and everything we were missing would be on there. You could easily see what you needed to complete and what you already have completed."

3. Ownership of learning appears not to be directly affected by the use of digital learning tools.
4. Feelings of control and comfort help learners proceed efficaciously.
5. Teachers expect too much from students and may be overworking them.
    - A student comments on the fast-paced digital environment: "I feel like I don't understand the content that much because of the fast-paced learning and having so many different assigned crammed into such little time. I feel that slow-paced learning will focus more on understanding and less on covering the content just because it needs to be covered"
6. Ownership of learning is not linked to study habits.

Appendix G

Noteworthy Responses

This appendix contains student and teacher responses that were especially noteworthy. Please find the survey questions emphasized using a bold font while participant responses can be found beneath each question in a standard, non-bold font.

Student Survey: Please describe your level of motivation when beginning new projects, DURING this semester. Were you typically excited to explore a new idea or were you simply 'going through the motions' of school?

"Usually when homework assignment were done on paper I would be more vigilant with how I placed the paper in my bag so it wouldn't rip and seeing it everyday just motivated me to complete the assignment and get rid of the assignment. This sort of a habit to declutter surprisingly helped me with my hw and reminded me that I had to send off these papers to my teacher. When I started working on a laptop this notion of decluttering was not present. Currently my bag has a my lunch and a laptop there are no loose papers needing to be handed in. This allows me to subconsiouclу ignore and put off assingment because I can't see them physically without opening the file/document up. So I am not able to stay motivated because I am a visual learner and need pen and paper to help me comprehed certain subjects."

Student Survey: This semester, Google Classroom was used as a hub for all our assignments and projects. They were distributed and resources were provided; you turned them in and received feedback, all in a digital setting. Do you think this digital approach is effective? Please explain.

“Yes I think the digital approach is effective because it's more efficient not only for students but for teachers to. I was talking to my older brother about this and he was regretting he didn't use this digital stuff when he was in high school. So yes I definitely think the digital approach is effective”

Teacher Survey: Please describe the level of focus or distraction your past students had when beginning a new assignment, as it was before introducing digital learning tools in your classroom.

“In my view students have always been easily distracted but sometimes motivated to study harder or get work done because of the fear of failure. This can be a powerful motivating force, but I have elected not to use this approach. As such I am often faced with simply appealing to the students with the idea that there is value in being motivated by success orientation rather than a fear of failure orientation. This is much more challenging for me than using tests and high-stakes assignments, but again, my interests extend beyond collecting data points on students and beyond meeting specific learning outcomes related to my course content.”

Teacher Survey: Please describe the level of focus or distraction your past students had when beginning a new assignment, as it was before introducing digital learning tools in your classroom.

“I find today's students are more easily distracted than the past. I could teach a 15-20 minute lesson easily in the past. Today, I am lucky to maintain student focus for 3-5 minutes.”

Student Survey: This semester, Google Classroom was used as a hub for all our assignments and projects. They were distributed and resources were provided; you turned them in and received feedback, all in a digital setting. Do you think this digital approach is effective? Please explain.

"I think this was much better than receiving feedback on paper. If you need to look back on feedback and see what you need to improve on, it will always be there. However, if you receive feedback on a paper, you could lose it and then not remember what you needed to fix or improve on."

Appendix H

MEMORIAL UNIVERSITY

Interdisciplinary Committee on
Ethics in Human Research (ICEHR)

St. John's, NL Canada A1C 5S7
Tel: 709 864-2561 icehr@mun.ca
www.mun.ca/research/ethics/humans/icehr

ICEHR Number:	**20181155-ED**
Approval Period:	December 7, 2017 – December 31, 2018
Funding Source:	Not Funded
Responsible Faculty:	Dr. Gabrielle Young Faculty of Education
Title of Project:	*An Exploratory Study of The Impact of Digital Learning Tools on Student Engagement, Self-Efficacy, and Ownership: Insights from Teachers and Students at a British Columbia High School*

December 7, 2017

Mr. Dennis Neufeld
Faculty of Education
Memorial University of Newfoundland

Dear Mr. Neufeld:

Thank you for your correspondence of December 5, 2017 addressing the issues raised by the Interdisciplinary Committee on Ethics in Human Research (ICEHR) concerning the above-named research project.

ICEHR has re-examined the proposal with the clarification and revisions submitted, and is satisfied that the concerns raised by the Committee have been adequately addressed. In accordance with the *Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS2)*, the project has been granted *full ethics clearance* to December 31, 2018. ICEHR approval applies to the ethical acceptability of the research, as per Article 6.3 of the *TCPS2*. Researchers are responsible for adherence to any other relevant University policies and/or funded or non-funded agreements that may be associated with the project.

If you need to make changes during the project, which may raise ethical concerns, please submit an amendment request with a description of these changes for the Committee's consideration. In addition, the *TCPS2* requires that you submit an annual update to ICEHR before December 31, 2018. If you plan to continue the project, you need to request renewal of your ethics clearance, and include a brief summary on the progress of your research. When the project no longer involves contact with human participants, is completed and/or terminated, you are required to provide the annual update with a final brief summary, and your file will be closed.

Annual updates and amendment requests can be submitted from your Researcher Portal account by clicking the *Applications: Post-Review* link on your Portal homepage.

We wish you success with your research.

Yours sincerely,

Kelly Blidook, Ph.D.
Vice-Chair, Interdisciplinary Committee on
Ethics in Human Research

KB/lw

cc: Supervisor – Dr. Gabrielle Young, Faculty of Education
Associate Dean, Research, Graduate Programs, Faculty of Education

Appendix I

ABBOTSFORD SCHOOL DISTRICT

June 16, 2017

Dennis Neufeld
Masters Student
(via email: dennis_neufeld@sd34.bc.ca)

Dear Dennis:

I am in receipt of your research request dated June 9, 2017 requesting permission to conduct research on 'What impact do digital learning tools have on student engagement, self-efficacy and ownership of learning at the secondary level?' This research will be conducted with Abbotsford School District students and staff - specifically your grade 10 English classes and one Biology 11 class.

This is to advise that permission is granted to approach students and teachers and invite them to participate in an anonymous survey which will consist of Likert scale questions. The questions will address fluency with technology, learning benefits, collaboration, communication and academic success.

Thank you for your dedication and interest in conducting your study within our school district. Best wishes as you conduct your research.

Sincerely,

Kevin Godden
Superintendent/CEO

KG:cs

2790 Tims Street
Abbotsford BC V2T 4M7
Tel 604.859.4891
Fax 604.852.8587
sd34.bc.ca

RESPECT OPPORTUNITY INNOVATION

Appendix J

PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Dennis Neufeld

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **9 April, 2017**

Appendix K

Curriculum Vitae

Name: Dennis James Neufeld

Post-Secondary Education and Degrees:

Memorial University of Newfoundland
Newfoundland and Labrador, Canada
2018
Master of Education: Information Technology

Simon Fraser University
Burnaby, British Columbia, Canada
2009
Bachelor of Education: Curriculum Design

University of the Fraser Valley
Abbotsford, British Columbia, Canada
2008
Bachelor of Arts

Related Work Experience:

Classroom Teacher: Grade 10 cross-curricular pod
Rick Hansen Secondary School
Abbotsford School District 34
2009 - 2018 (pod since 2016)

- Worked with a cross-curricular teaching team (English, Science and Social Studies) to design and implement a cross-curricular and project-based learning design, using digital learning tools extensively. Primary tools consisted of Google Apps for Education suite, including Google Classroom learning management system (LMS).

Technology Integration Team
Rick Hansen Secondary School
Abbotsford School District 34
2014 - 2016

- Worked with a team of passionate technology users to assist school staff with technology training and implementation.

Distance Education Teacher
Abbotsford Virtual School
Abbotsford School District 34
2015 - 2016

- Administered and modified online distance-education courses using the Moodle 2.0 LMS. Corresponded with students in an online environment, providing feedback and assistance with course material as well as navigating and troubleshooting digital tools.

Course Designer
British Columbia Learning Network
2013

- Designed interactive and self-directed, online photography and video production courses using the Moodle LMS

Relevant Certifications:

Google Certified Educator: Level 1
2017

Abbotsford Virtual School certification
2013